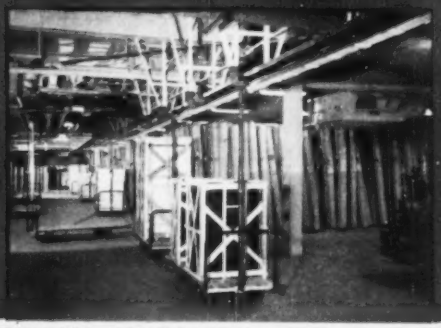
FEBRUARY • 1953
PRICE 25 CENTS

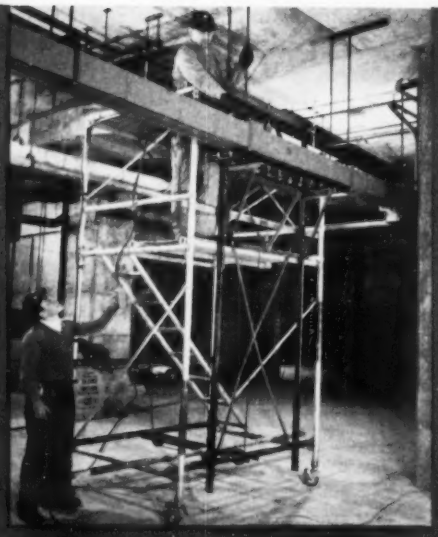
ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



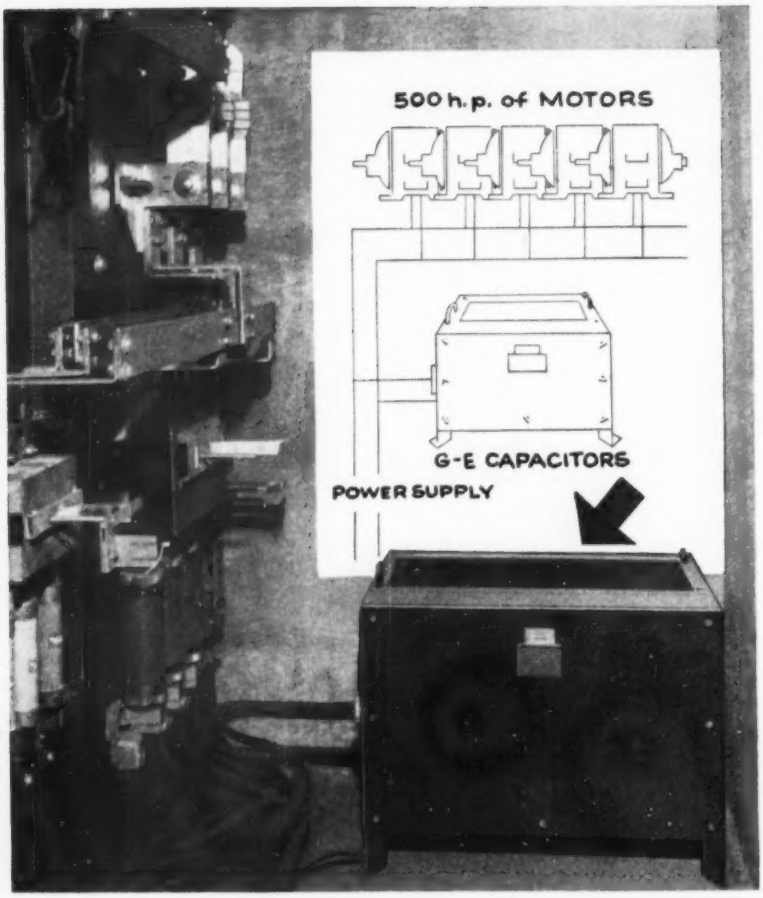
ELECTRICALLY DRIVEN *materials handling in a large Utah wholesale house.*

ALL LUMINOUS *ceiling applied to a Poughkeepsie super market.*



PLATFORM HOIST *with rollers speeds Detroit contractor's busway installation.*

A McGRAW-HILL PUBLICATION | 52ND YEAR



Low power factor was penalizing a West Coast meat packing plant until G-E engineers recommended the installation (arrow) of a 60-kvar, 3-phase 60-cycle, 460-volt G-E capacitor equipment.

$355 investment saves up to $47 every month!

WEST COAST MEAT PACKING PLANT INSTALLS GENERAL ELECTRIC CAPACITORS AND CUTS POWER COSTS

Induction motors caused low power factor. Because it takes about 500 hp of induction motors to run a plant that processes between 1500 and 2000 head of beef a day, a West Coast packing plant had a power factor that seldom got above 81%. Rebates on the plant's power bill were down to about $3 a month.

Power factor raised from 81% to 96%. Then G-E engineers recommended the installation of 60 kvar of G-E capacitors at a total cost of $355*. After the capacitors were installed the power factor rose to better than 96% and stayed there. Rebates on the power bill now average between $45 and $50 every month. Thus, in less than nine months, the company realized a saving greater than the cost of the capacitor equipment. ***And these monthly savings will go on indefinitely.***

*Cost of capacitor equipment in 1949. Prices slightly higher now.

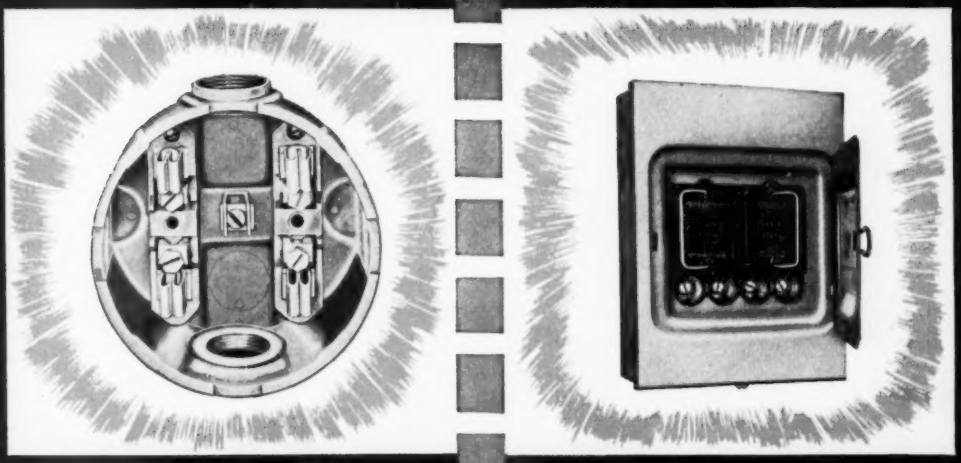
Capacitors can help in other ways, too! Besides raising power factor, capacitors often permit your present distribution system to carry 20 to 30% more load without added equipment. Where voltage drop is a problem, capacitors can also provide the needed voltage boost inexpensively.

They're the key to lower power costs. This West Coast plant is just one of the many that are cutting power costs with capacitors. If your power factor is below 85% and if there is a power-factor or kva-demand clause in your power contract, chances are you can make similar worth-while savings. Your local G-E sales office or authorized G-E agent or distributor can help you—or write to Section 407-207 for booklet GEA-5632—"How to Use Capacitors to Reduce Power Costs and Gain System Capacity." *General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

407-207

They're Designed to MATCH



And Save you MONEY

Make the job easier and quicker by using Murray matched equipment. All elements of each unit are designed to go together. Take the Murray Meter Socket and the Murray "Main and Range" illustrated. Installation is easier and quicker because knock-outs are positioned just right. Wiring is simplified because lugs are similar on both units. In addition, once installed, Murray matched equipment looks better and more workmanlike than devices from two different manufacturers.

HERE'S *Proof* THAT Murray MATCHED EQUIPMENT *SAVES MONEY!*

Levittown, Long Island (17,000 homes) is using Murray matched equipment to handle the load. Now, another large project is being developed —16,000 homes at Levittown, Pennsylvania. Murray matched equipment is being used again!

Further proof of the advantages of matched equipment is at Fairless Hills, Pennsylvania — a project of 4000 homes. The Murray Meter Socket and the Murray "Main and Range" are back-to-back on a large percentage of these homes.

It comes down to this — Murray matched equipment saves time in installation — and time is *money*. Whether it's a huge project or a bungalow — matched equipment saves time and money.

One out of the 16,000 modern houses being built at Levittown, Pa. Murray Meter Socket is located on outside wall, rear. Murray "Main and Range," located in a utility closet, backs it up on the inside.

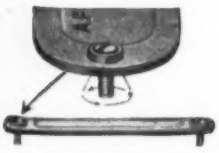
Electricians like Murray equipment because it's easy to install. There's always plenty of wiring room in Murray equipment!

MURRAY MANUFACTURING CORPORATION
1250 Atlantic Avenue, Brooklyn 16, New York

Service Entrance & Meter Equipment • Magnetic Hydraulic Circuit Breakers • Safety Switches (Types A, C & D) • Current Limiting Reactors • Crows'nest Aerial Ladders

No lost screws, No scuffed fingers, No lost time!

USE APPLETON LOKT-SCREW COVERS FOR FORM 35 UNILETS



New "Ball-and-Socket" Action Screws!

End view of time-saving "Lokt-Screw" cover shows rocking action of "Ball-and-socket" type screws, permitting one side of cover to be completely tightened before tightening of second screw begins. Screws are held permanently in place by steel of the cover itself!

New Appleton **LOKT•SCREW** covers offer time and trouble saving advantages you find in no other conduit fitting cover—and you get them at no extra cost!

Precision-threaded, easy-turning screws on Appleton **LOKT•SCREW** covers are held permanently in place by steel collars which completely surround screws, a feature which also prevents finger-bruising screw-driver slippage.

The Appleton **LOKT•SCREW** cover is only one of hundreds of Appleton wiring devices expressly designed to bring greater speed and convenience to every job. For highest quality fittings to meet every wiring requirement, specify Appleton—The Standard for Better Wiring.

Sold Through Electrical Wholesalers

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APPLETON

OUTLET BOXES AND SWITCH BOXES

ELECTRIC

INDUSTRIAL LIGHTING EQUIPMENT

PRODUCTS

EXPLOSION-PROOF FITTINGS • KEELITES

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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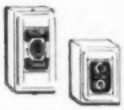
GENERAL-PURPOSE CONTROL

Fhp motor starter

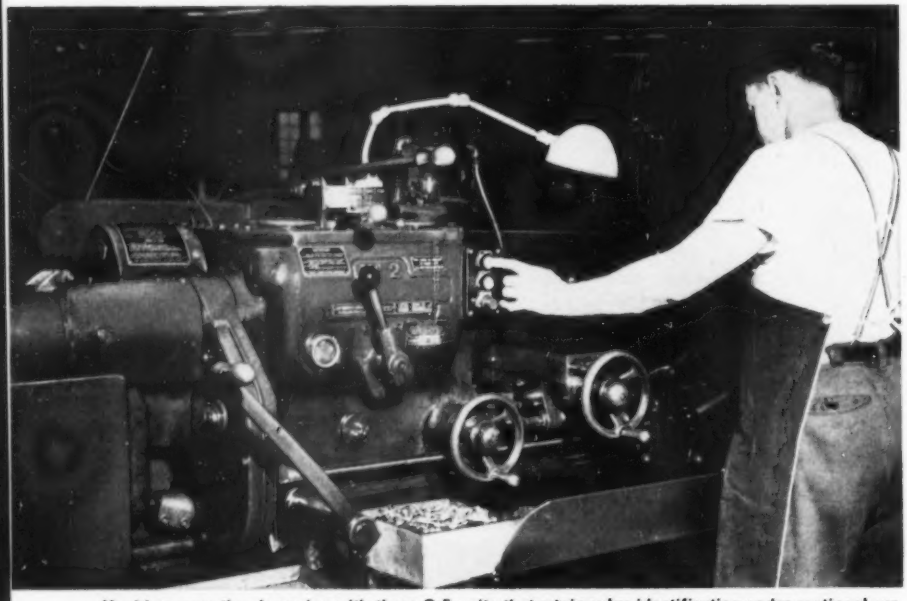

1—7½ hp manual motor starters

A-c magnetic motor starter

Combination motor starter

Reversing motor starter

New G-E Oil-tight Units — Modern Design for Modern Machines



Machine operation is easier with these G-E units that retain color identification under continual use

An entirely new concept of push-button design means greater flexibility, easier installation, and longer life of these units on your machines.

VARIETY OF FORMS AVAILABLE

Interchangeable rings are available in five colors—will fit both push-button and selector switch forms. No need to order complete units to get a special color. Operators are available with extra long button, mushroom head, locking attachment, cylinder lock, and in combination units in addition to the standard push-button and selector switch forms.

One basic form of contact block fits these operators; is attached by means of two screws. You save time and money in ordering or making up the forms you need.

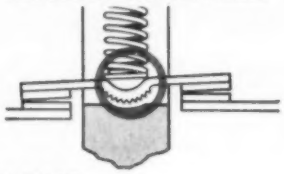
COMPACT ENCLOSURES

In stations or enclosures these units are back mounted—simplifying wiring, and making a neat arrangement. Stations designed in accordance with JIC specifications are of strong, lightweight cast aluminum with a Buna-N gasket to keep out oil, water, and coolant.

BUILDING BLOCK CONSTRUCTION:

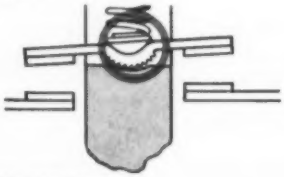
The same basic contact block is used on all push-buttons and selector switches. Double-pole, double-throw combinations are made by mounting two blocks on the same base. Tandem combinations with four contact blocks are easily made up by using an adapter plate. Write for Bulletin GEA-5779. ***General Electric Company, Schenectady, N. Y.***

G-E SELF-A-LINE CONTACTS



ON MAKE:

When stationary contacts are misaligned movable contacts align with them.



ON BREAK:

Contacts always break evenly regardless of any misalignment of stationary contacts.

Wear is distributed evenly over both contact surfaces. Result: a 2:1 increase in life—by actual load-life tests.

LONG ELECTRICAL LIFE:

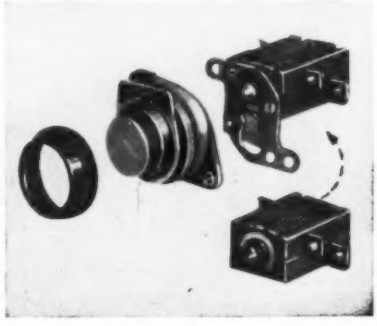
Unique self-a-line contacts assure equal distribution of arcing on the double-break contacts which prevents excessive and cumulative burning of the tips. Wipe on both normally open and normally closed contacts prevents false operation under vibration. Arc-resistant melamine contact block has long life.

ATTRACTIVE, BUT PRACTICAL:

Color stays clean and bright because it's anodized in the ring, and around the button away from area of use. Color coding can be seen from the side as well as the front. Smooth, rounded contour blends with modern machine design. Standard or extra-large nameplates available for all forms.

EASILY INSTALLED:

Contact blocks, operators and color rings can be assembled with little effort. Wiring is simple. Large pan-head No. 8 screws with terminal clamps easily take No. 12 wire and cannot be twisted off when tightened. Screw will also take solderless-type lugs. Only normal hand tightening is required to make unit oil-tight because of a special washer.



Inventory is reduced with these G-E units that have interchangeable color rings, separable operators, and one basic form of contact block.

INFORMATION FOR CONTRACTORS—PLANT ELECTRICIANS

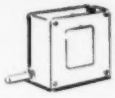
Reduced voltage starter

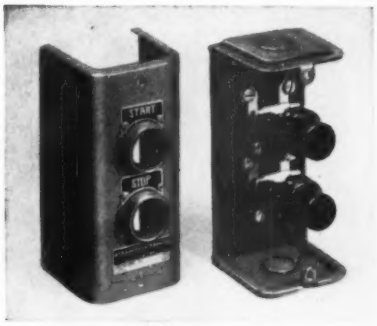
Heavy and standard-duty push-button stations

General-purpose relay

A-c and d-c solenoids

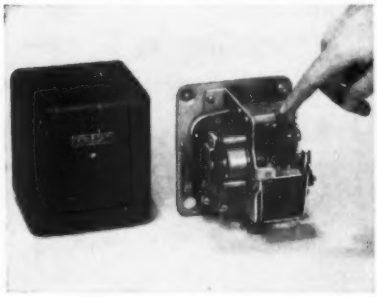
Roller-lever type limit switch


Rotating-type limit switch



HEAVY-DUTY PUSH-BUTTON STATIONS ARE VIBRATION RESISTANT—LONG LIVED

Enclosed in a strong steel case, G-E heavy duty units have silver-tipped contacts with strong springs that stand up under constant vibration and use. Many combinations are possible with momentary and maintained-contact buttons, selector switches, and indicating lights. Terminals are large for easy wiring. Large buttons encircled by guard rings prevent accidental operation. Surface and flush-mounted stations available. Bulletin GEA-5043 describes all forms.

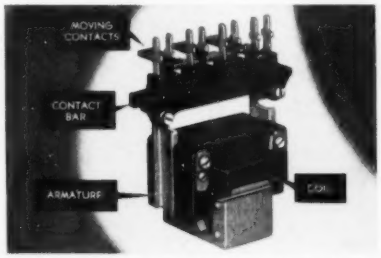


ACCURATE TIMING WITH THIS RELAY—STEPLESS ADJUSTMENT

For process timing this relay has a repeat accuracy of 0.5 per cent of maximum time setting. Four forms available for time ranges of 3 to 100 seconds up to 12 minutes to 6⅔ hours. Synchronous motor driven. Switch has both an instantaneous and time open/time closed contact. For more information on this easily adjusted timing relay write for Bulletin GEC-600.

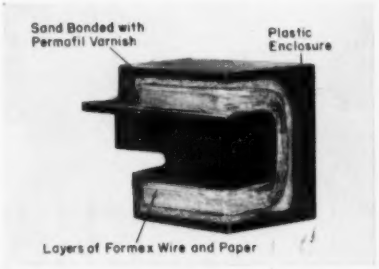
STRONGBOX COIL MEANS EXTRA LONG LIFE FOR G-E MAGNETIC MOTOR STARTERS

This unique plastic-encased coil resists moisture, dust, and oil—cannot be damaged by a slipping screwdriver during wiring and installation. Permafil* varnish, which does not liquefy in heat, prevents windings of Formex* magnet wire from abrasion under vibration and is sealed under vacuum so no "hot spots" can develop.



Coil acts as permanently lubricated guide to moving magnet. No metal-to-metal friction.

**Reg. trade-mark of General Electric Co.*



G-E Strongbox magnet coil has windings encased in molded plastic to prevent damage from vibration, moisture, dust, and screwdrivers.

The grooved sides of the plastic enclosure serve as guides to the moving magnet armature. A lubricant impregnated in the block reduces friction for fast, easy action at all times. There is no rubbing of metal against metal, so wear is reduced. Positive "make" and "break".

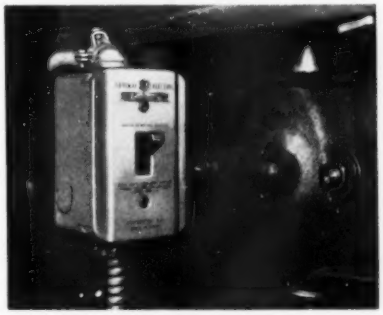
Wiring is easy. When the screw is backed off to make room for insertion of the wire, the clamps and lockwasher follow the screw head.

Coils are easily interchanged, come in ratings of 110, 220, 440, 550, and 600 volts. Simply remove four easy-to-reach screws, and the coil slips out over the stationary magnet. Design is simple, compact. Coil terminals are front-connected, clamp-type—solidly anchored in the plastic enclosure—will not twist loose when tightened on the wire.

Ask for the starter with the Strongbox coil—it's an exclusive feature of all G-E a-c full-voltage magnetic starters in NEMA Sizes 0 through 3 for one to 50 hp motors. Write for Bulletin GEC-880.

FRACTIONAL-HP MOTOR STARTERS HAVE EXTRA PROTECTION FEATURES

Bi-metallic overload relays take a variety of heater sizes—tab in operating handle quickly identifies rating. On overload, handle moves to OFF for position indication. Protection to contacts and overload relay is provided by a plastic enclosure within the steel case. The outer case has four ½-inch and two combination knockouts for easy mounting. Write for Bulletin GEA-2234.



For more information contact your nearest G-E representative, agent, or distributor or write Section A730-43, General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

To enhance its CENTURY OLD Beauty

THE BERLIN CONGREGATIONAL CHURCH
IN BERLIN, CONNECTICUT

CHOSE

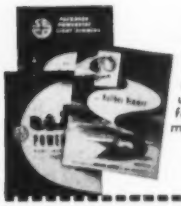
POWERSTAT

Light Dimming Equipment

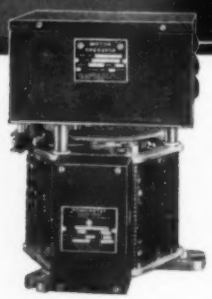
WITH CONVENIENT MULTI-STATION REMOTE CONTROL

The simple, forthright beauty of this more-than-a-century-old house of worship is greatly enhanced by effective light control. By providing smooth, stepless dimming and brightening of light, much is contributed to the atmosphere of dignity and reverence.

The choice of a Motor-Driven POWERSTAT Dimmer offers maximum convenience in operation. Simple raise-lower switches in the pulpit, at the organ and in the rear of the church allow complete control of the entire lighting system from any of these three stations. The dimmer unit is unobtrusively located in the cellar.



There is a POWERSTAT Dimmer just right for every requirement . . . simply and easily installed in new or existing circuits. Get complete information now; use the handy attached coupon to send for literature on POWERSTAT light dimming equipment.



6023 DEMERS AVENUE, BRISTOL, CONN.

Please send literature on POWERSTAT light dimming equipment.

NAME_____

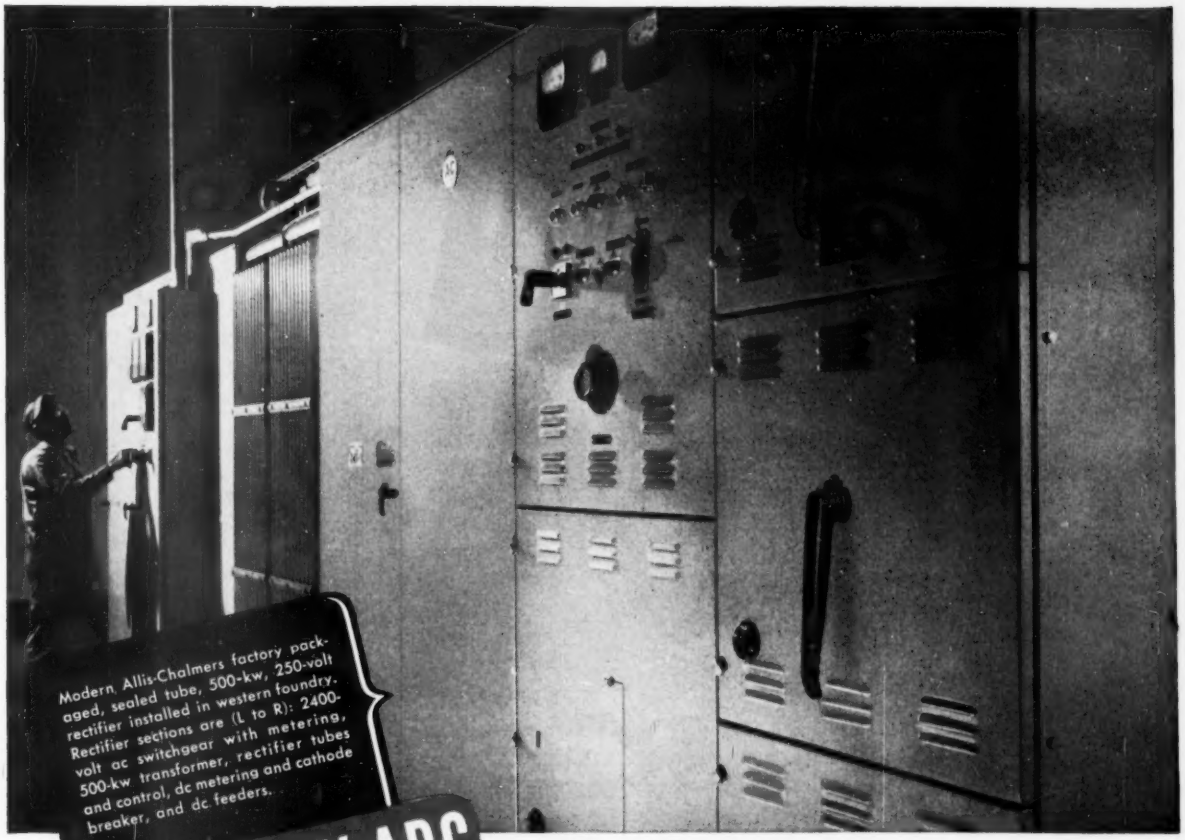
POSITION_____

COMPANY_____

CO. ADDRESS_____

CITY_____ ZONE_____ STATE_____

THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT



Modern Allis-Chalmers factory packaged, sealed tube, 500-kw, 250-volt rectifier installed in western foundry. Rectifier sections are (L to R): 2400-volt ac switchgear with metering, 500-kw transformer, rectifier tubes and control, dc metering and cathode breaker, and dc feeders.

MERCURY ARC RECTIFIERS For Critical DC Service

Supply Power for Centrifugal Pipe Casting Machines at Western Foundry

PRODUCTION UNIFORMITY DEPENDS on accurately regulated dc supply at the U. S. Pipe & Foundry Company, Decoto, California.

Variable speed dc drives on the centrifugal pipe casting machines *must* start quickly and accelerate at a *controlled* rate to distribute the melt uniformly throughout the mold before it hardens. *Reliability* is also vital since dc powers not only the casting machines but also the cranes transporting the molten metal.

The Allis-Chalmers 500-kw sealed tube mercury arc rectifier seen here was recently installed to meet these critical requirements. This rectifier combines the good regulation and low maintenance characteristics of the mercury arc rectifier with the following *exclusive* A-C refinements:

- **Fixed excitation anode** that doesn't contact mercury and is independent of level, turbulence or impurities.
- **Continuous excitation** — pilot arc always present, eliminating need for continuous and synchronized re-ignition. Rectifier will ride through severe ac voltage disturbances.
- **Grid phase control** — in cleaner region near anode, where ion density is lowest.
- **Internal cooling system** — high heat transfer with seamless tube cooling coil located within the rectifier.
- **Arcover-free tube** — eliminates danger of arcing-over to tube by insulating entire arc path.
- **Enameled anode seals** — multi-layer fused vitreous construction provides high strength, trouble-free seal.

Allis-Chalmers sealed tube rectifiers are supplied in ratings from 200 kw at 250 volts to 1000 kw at 600 volts. When planning a rectifier installation of *any* size, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis.

A-3855

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry

USED THE MOST FROM COAST TO COAST

For many years Contractors from Coast to Coast have used Briegel All Steel Indenter Fittings. U. L. approved as concretetight and for general use, B-M Indenter Fittings are faster, easier to use and neater in appearance.

Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!

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GALVA, • ILLINOIS

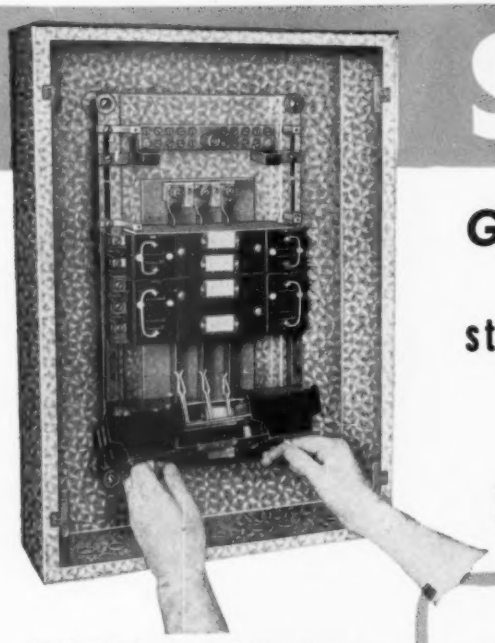
Distributed by

The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Nikoh Tube Co., 5000 South Whipple St., Chicago, Ill.; Clifton Conduit Co., Jersey City, N. J.; The Steelduct Co., Youngstown, Ohio; Columbia Cable & Electric Corp., 255 Chestnut St., Brooklyn, N. Y.; Pittsburgh Standard Conduit Co., Pittsburgh, Penn.; Wagner Malleable Products Co., Decatur, Ill.; J. R. Richards Co., Carnegie, Penn.; Kondu Mfg. Co., Ltd., Preston, Ont.

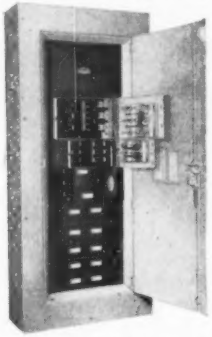
SAVE TIME . . . LABOR

Get faster deliveries with standardized FA interchangeable

PLUG-IN FEEDER PANELBOARDS



Pulfuzswitch Type of Panelboard with 30 ampere, 2 and 3 pole branches. Box is 19½" wide and 4¾" deep.



Panelboard illustrated is a combination of Pulfuzswitch and Klampswitchfuz branches. Box size is 24" wide and 10" deep.

Branch Circuit capacities are as follows:

- **PULFUZSWITCH** 30, 60 and 100 amperes, 250 volts AC or DC; 30 and 60 amperes, 600 volts AC, 2, 3 and 4 poles.
- **KLAMPSWITCHFUZ** 30 to 600 amperes, 250 volts AC or DC, 2, 3 and 4 poles.
- **SNUFARC** 30 to 200 amperes, 600 volts AC, 2, 3 and 4 poles.
- **SHUTLBRAK** 30 to 1200 amperes, 250 volts AC or DC, and 600 volts AC, 2, 3 and 4 poles.

Here's a panelboard that measures up fully to the modern demand for safe, efficient, economical and dependable power and light distribution.

Built of standardized units and assembled as required for specific application, FA Interchangeable Plug-In Feeder Panelboards not only provide adequate capacity for today's needs, but are so designed that future additions of circuits and changes in capacity can be made a simple matter of adding new units.

Three dependable FA Switches — the Pulfuzswitch, Klampswitchfuz and the Snufarc — make these panelboards the finest in safety and efficiency. All types combine switch and fuse in one unit so that current is "OFF" when the fuse carrier is removed or the door opened. This makes replacement of fuses safe, quick and simple.

Boxes are standardized as to width, height and depth to meet any combination of branches or any job requirement. They are shipped from stock, thus facilitating delivery. Except for smaller sizes, all boxes have removable ends to permit drilling of conduit openings on the job. Smaller boxes have standard knockout layout in ends. Generous wiring space and ease of installation are other features.

For operating switch requirements FA Shutlbrak Type A quick make and quick break interlocking switches are available.

Want to know more about these modern panelboards? Your nearest FA representative, listed in Sweet's, will be glad to provide it.

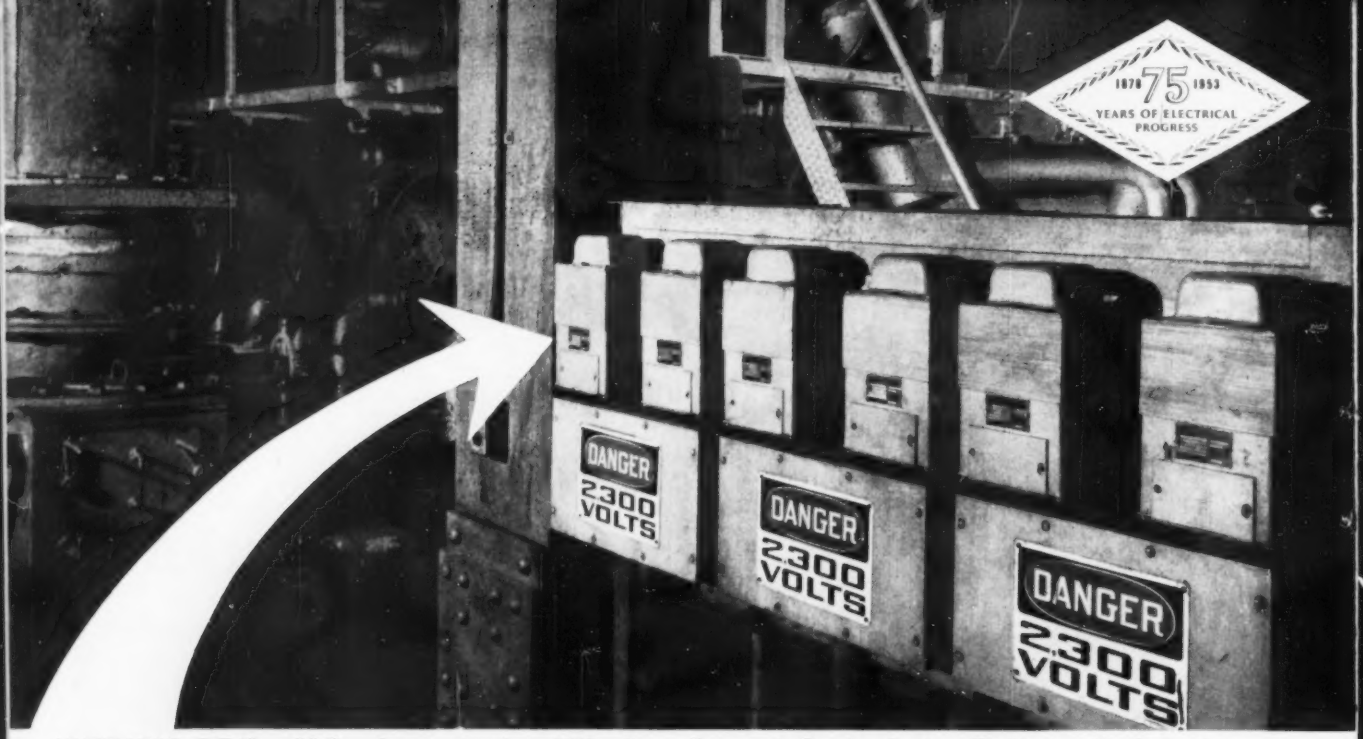
Frank Adam Electric Co.

P. O. BOX 357 ST. LOUIS 3, MISSOURI

FA TRADE MARK

Our 62nd Year

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER



AT THE LOAD, G-E Type M Transformers step down 2300 volts to level required for boiler control at Potomac Electric Power Company's Benning Station, Washington, D. C. In this way, G-E Dry-Types allow efficient use of high voltage distribution.

G-E Dry-Type Transformers at the Load Can Help Cut Your Plant's Power Losses

By supplying the correct voltage where you need it, G-E Dry-Type Transformers eliminate long runs of expensive, secondary feeders. This cuts line losses, reduces wiring costs, helps stretch your power dollars. And *throughout* industry, *wherever* voltage changes are required, G-E Dry-Types at the load can do this job efficiently.

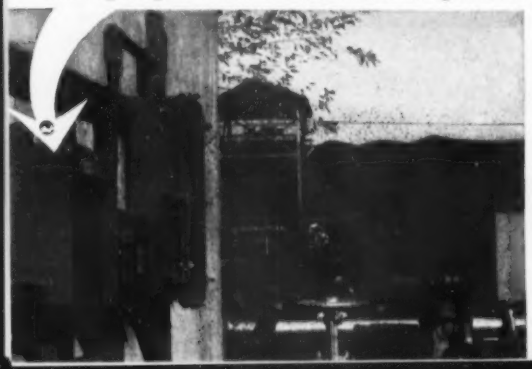
Lightweight G-E Dry-Type Transformers are easy to install. You can mount them out of the way on columns, wall brackets or platforms. Solderless connectors on many of the higher ratings do away with splicing, soldering and taping. And you save on maintenance, too. Designed for quiet operation and efficient cooling, these G-E transformers require virtually no inspection, once installed.

For further information on how G-E Dry-Type Transformers can cut power losses in your plant, call your nearest authorized G-E distributor. Or write for bulletin GEC-868A, Section 411-106, General Electric Company, Schenectady 5, New York.

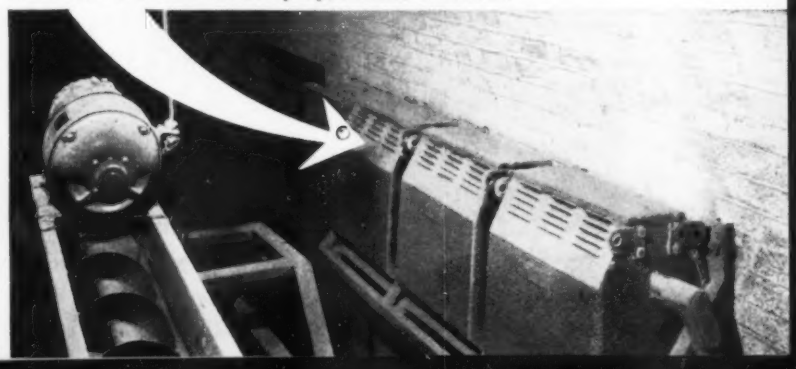
You can put your confidence in—

GENERAL ELECTRIC

OUTDOOR loads can be served by G-E Type M's. This one, mounted near load, supplies voltage for oil tank lighting at Potomac Electric's Benning Station.



INDOOR loads can use Type M's (.25 thru 15 kva) or Type D's (25 kva and above). These General Electric Type D transformers serve lighting circuits at Producers Cotton Oil Company, Fresno, California.



EASY

TO BEND . . . flexible and strong

TO CUT on the job

TO HANDLE . . . free stripping

COLUMBIA

A.B.C. Armored Cable

The Safe, Economical, Grounded, Steel Covered Wiring System

Flexible, strong and easy-to-handle, Columbia A.B.C. Armored Cable is galvanized to resist corrosion. Rubber covered conductors mean safe, dependable wiring. And, Columbia gives you the kind of service that keeps your jobs "on-schedule."

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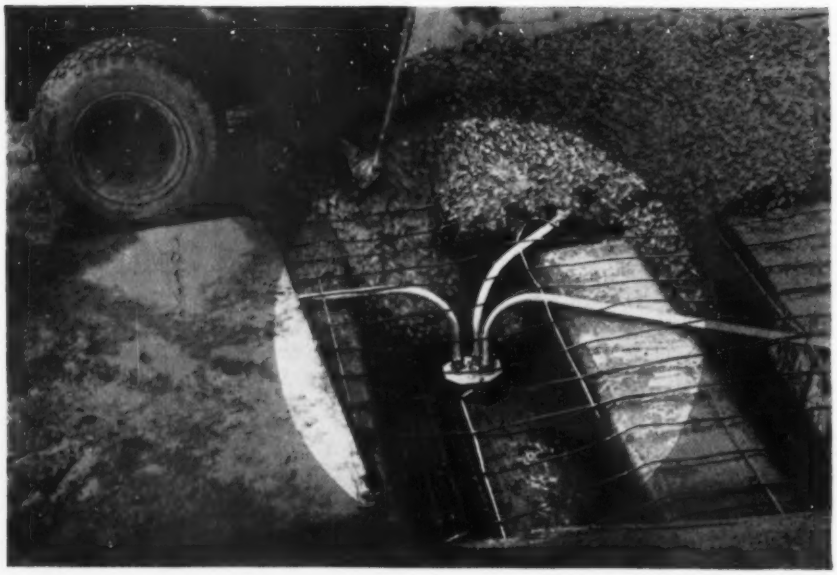
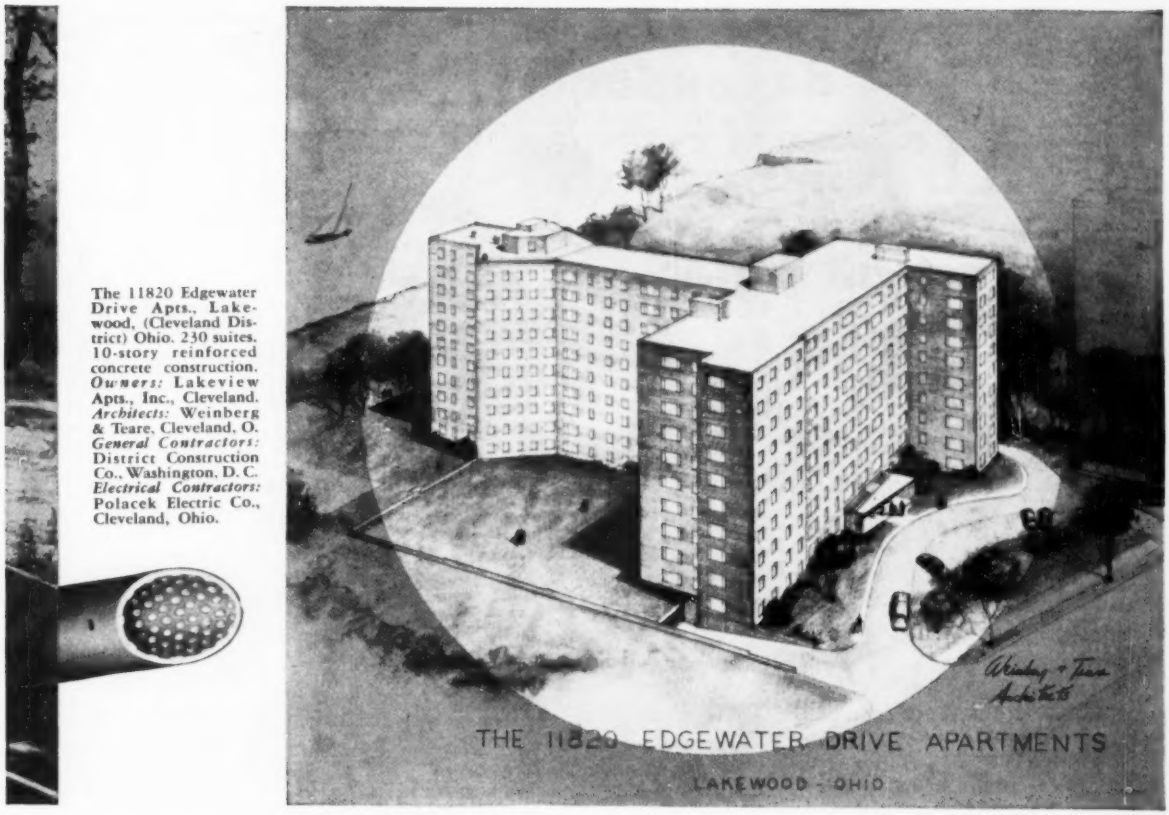
NON-METALLIC SHEATHED CABLE | FLEXIBLE STEEL CONDUIT | E. M. T. | A.B.C. ARMORED CABLE

"Inch-Marked" lengths, an ELECTRUNITE *exclusive, permit fast, accurate bends on the job or in the shop.*

Easy to install right



Easy to install in narrow spaces between pans. No exposed threads to rust.



The 11820 Edgewater Drive Apts., Lakewood, (Cleveland District) Ohio. 230 suites. 10-story reinforced concrete construction. *Owners:* Lakeview Apts., Inc., Cleveland. *Architects:* Weinberg & Teare, Cleveland, O. *General Contractors:* District Construction Co., Washington, D. C. *Electrical Contractors:* Polacek Electric Co., Cleveland, Ohio.

on concrete pan jobs . . . . REPUBLIC ELECTRUNITE ...the "Inch-marked®" E.M.T.

Republic ELECTRUNITE E.M.T. is easily formed and bent to fit into the narrow spaces between pans. The easy-to-use compression connectors make joints concrete-tight without turning whole runs or moving outlet boxes to tighten.

This light-and-strong steel raceway material has many installation advantages for concrete construction. It is unnecessary to use special concrete boxes . . . the tube is easily hooked up with connectors installed on boxes before spotting on the form.

The exclusive ELECTRUNITE "Inch-marked" feature speeds accurate cutting and bending. The exclusive ELECTRUNITE inside-knurled surface makes wire-pulling easier and more trouble-free. For *all* your jobs, concrete, exposed, or concealed, where "E. M. T." or "thin-wall" meets the code, order the brand that gives you the most benefits . . . Republic ELECTRUNITE E.M.T.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
212 EAST 131st STREET • CLEVELAND 8, OHIO

Republic
REPUBLIC STEEL
ELECTRUNITE E.M.T.

dependable McGILL® lamp guards outlast all others

Here are two of the many McGill portable lamp guards that will withstand the hard wear and abuse of heavy industrial use. McGill 7000 and 650 series lamp guards last many times longer than ordinary guards because of exclusive design, heavier and better quality material and superior workmanship.

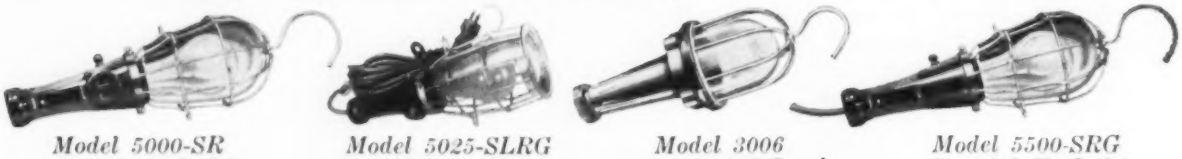
These models have pliable molded rubber handles and extra heavy steel wire cages that are electrically welded for strength and zinc plated with chrome finish to remain clean and bright for years. Sockets are 660 watt 250 volt, either plain or waterproof.

Such extras as cord seals, larger hooks and No-Rol ears to prevent cage rolling add to the safety and convenience of using dependable McGill portable lamp guards.

Model 7000-SR with Rubber Handle, Reflector and Levolier Switch.

Model 650-SR with Curved Rubber Handle. This exclusive handle design permits hanging portable cage down so that light is free from any possible handle obstruction.

all are McGILL® quality



Model 5000-SR
Convenience Outlet, Reflector and Switch.

Model 5025-SLRG
Grounded Concentrating Lens.

Model 3006
Vaporproof Guard.

Model 5500-SRG
Grounded, No Outlet, Closed End Cage.

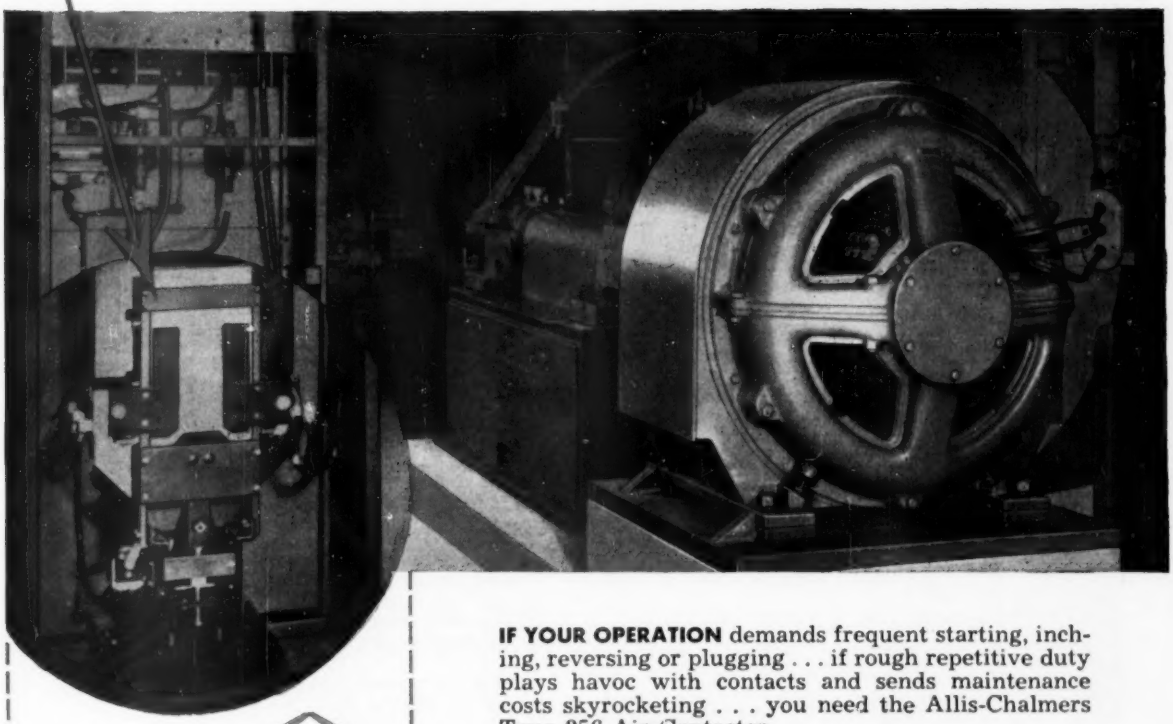
Send for the new McGill Catalog No. 49-A describing the complete line of McGill Lamp Guards, Sockets and Switches.

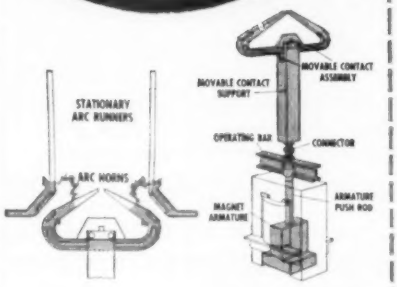
McGILL MANUFACTURING COMPANY, INC.
450 N. Campbell St., Valparaiso, Indiana

McGILL®
electrical specialties

ALLIS-CHALMERS
TYPE 256
Air Contactors

CUT Maintenance Cost





Double-break contacts, vertical action, dual blowout structure and other features speed arc extinction . . . assure long life and low maintenance.

IF YOUR OPERATION demands frequent starting, inching, reversing or plugging . . . if rough repetitive duty plays havoc with contacts and sends maintenance costs skyrocketing . . . you need the Allis-Chalmers Type 256 Air Contactor.

No Turning Shafts — No Shaft Bearings

The elimination of turning shafts, shaft bearings and flexible contact leads minimizes mechanical wear. Double-break contacts of arc resistant alloys, *operating in air,* straightline vertical action and fast arc extinction add months of contact wear. Actual case histories of "once-a-minute interruption" duty have revealed little contact wear in a full year's operation.

Replacement Units

Compact design permits installation in a cubicle used for oil immersed units in existing starters. And, of course, the Type 256 Air Contactor is also available in Allis-Chalmers Type H Starters.

Call your nearby A-C representative or write for Bulletins 14B7303 and 14B6410. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3945

A-C ALLIS-CHALMERS

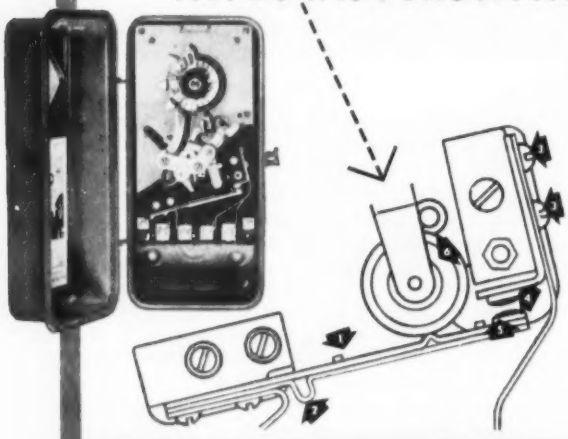
ALLIS-CHALMERS

for time switch quality *you'll never do better* than to choose Sangamo

When the chips are down—when you need a time switch that's *got to be good*—choose a SANGAMO . . . you'll never do better.

Why? Because Sangamo Time Switches were never built to merely meet minimum requirements. Sangamo Heavy Duty Time Switches have the exclusive Sangamo-built, slow speed motor that is quiet—needs no replacement, no repair, no oiling—that has the ability to keep operating under great temperature variations (from 50° below zero to 200° above!)—and that guarantees long life.

But the motor is only one of the reasons for the Sangamo reputation for quality.



here's the reason . . . for exceptional long contact life:

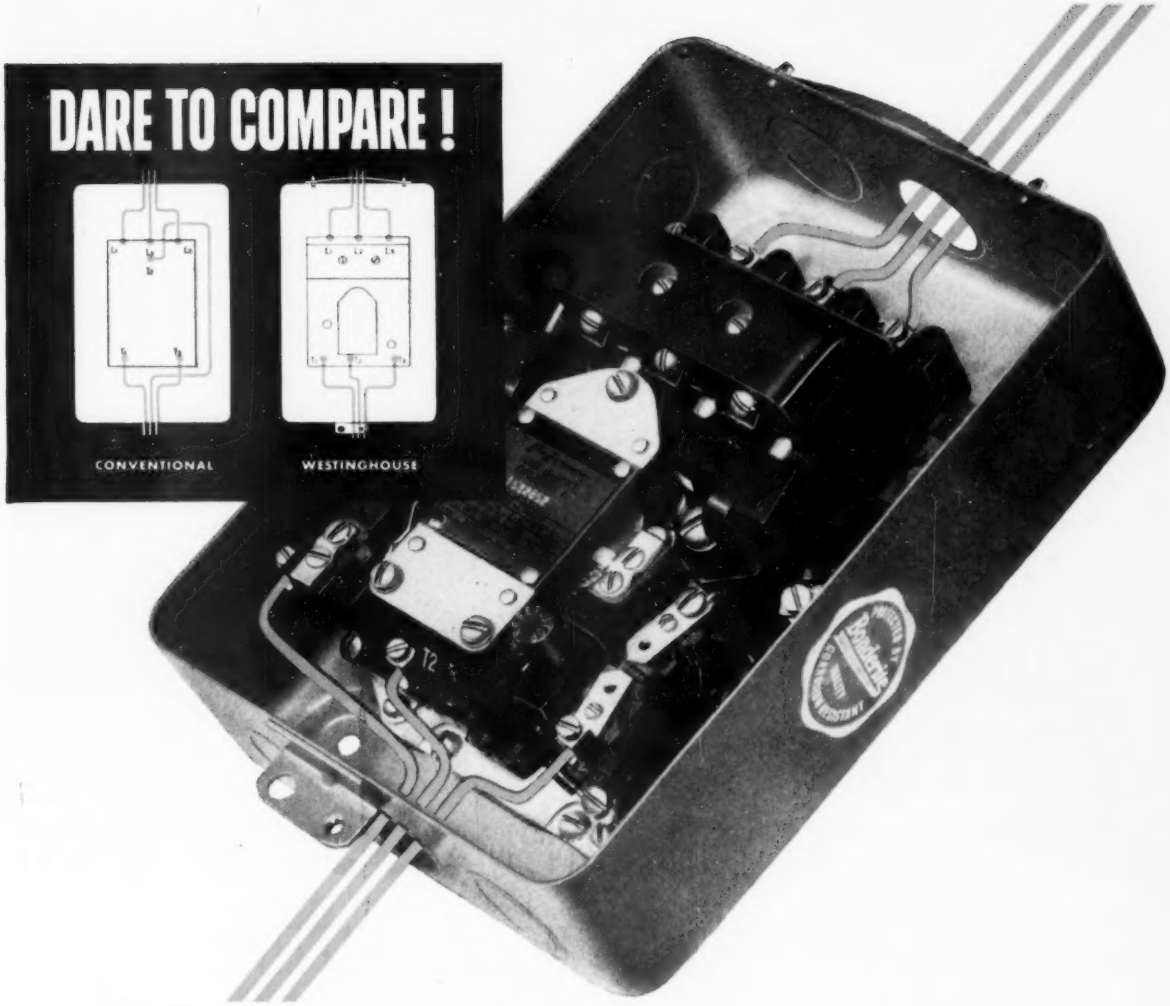
1. Spring member for maintaining proper contact pressure.
2. Flexible copper conductor for high current carrying capacity.
3. Stationary contact adjustment screws for easy setting of gap.
4. Heavy silver contacts for low-resistance and long life.
5. Curved contact surface for central point of contact when closed, and small gap when open—for minimum damage from arcing.
6. Roller for low-friction contact operation.

* Your electrical wholesaler can furnish all types of *dependable* Sangamo Time Switches. See them before you specify the time control for your next installation. Bulletin 1010 tells the full story—write today.

for your most exacting installations

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

ST53-2



Save wire...save time with Westinghouse *Life-Line*starters

Lead wires for Westinghouse Life-Linestarters go straight to clearly indicated terminals (see above right). This makes wiring extremely simple: Anyone can do the job without a diagram. Wiring isn't crowded, cluttered or wasted as in ordinary solenoid-type starters.

Neat, straight-through Life-Linestarter wiring:

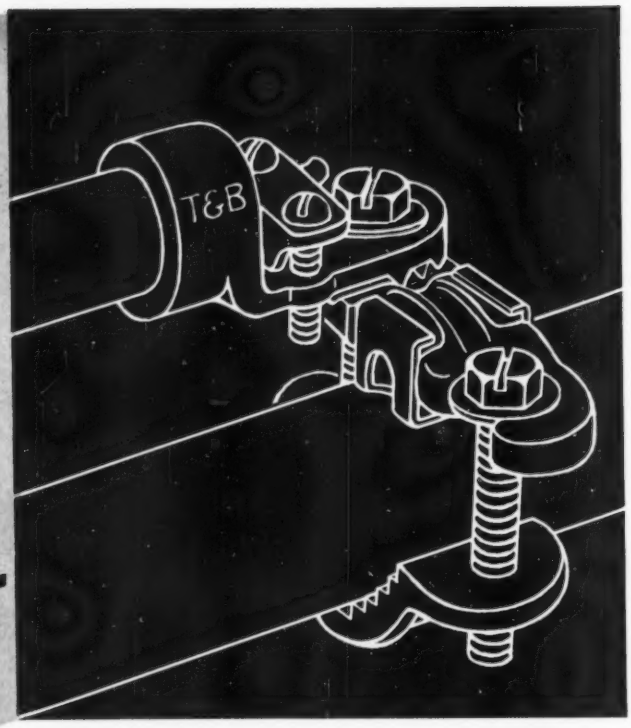
- Saves 12″ to 14″ of critical copper wire per unit. An important cost saving where many starters are installed.
- Simplified by the use of pressure-type connectors throughout. Merely strip the insulation and insert the wire. No need for soldering irons or crimping tools. You get a positive low-resistance connection for either solid or stranded wire.
- Prevents kinking of wire and breaking of wire's insulation.
- Keeps both sides of contactor inside enclosure clear of wires, allows ample space for special leads.

For complete facts call your Westinghouse Representative or write for B-4677. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-30105

YOU CAN BE SURE...IF IT'S
Westinghouse
*Life-Line*starters

T&B WITH HUBS AND CLAMPS...



YOU CAN MAKE **30** DIFFERENT T & B GROUND FITTINGS

Look for this sign-

IT'S THE MARK OF AN AUTHORIZED DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T35

Just combine the proper hub and clamp and you'll meet almost any grounding need

You can run *conduit-protected* ground wire through conduit from ½" to 1"... ground both conduit and wire to any water pipe from ¼" to 6".

You can ground #8, 6 or 4 *armored* wire to the same range of pipe sizes. Just bolt an armored-wire hub to the right size clamp.

Or you can attach #8, 6 or 4 *bare* wire to the solderless grip on the clamp — no hub needed.

T & B hubs and clamps have built-in solderless connectors. They're easily installed with wrench or screwdriver. Teeth on hubs and clamps permit locking at any angle. Clamps can be used alone with bare ground conductor up to #4 wire ... UL approved, meet 1951 NEC Code. And, like all T & B quality fittings, they're designed for lowest installed cost. Check for yourself—write for a free copy of Bulletin #65 covering the complete line of T & B cable and raceway fittings.

THE THOMAS & BETTS CO.

INCORPORATED

34 Butler Street • Elizabeth 1, New Jersey
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MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

Receptacles, Plugs and Switches

R&S
Type FS Waterproof Switches
Type FS Waterproof Receptacles and Plugs
Angle Type Plugs and Receptacles
Ever-Lok Plugs and Receptacles
Explosion-Proof Delayed Action Receptacles and Plugs
Explosion-Proof Push Button Stations and Heavy Duty Tumbler Switches
Interlocked Switch Receptacles and Plugs

—first line of defense against weather, water and industrial hazards!

R&S receptacles, plugs, connectors and switches are available in an endless variety of weatherproof, waterproof and explosion-proof types, sizes and assembly combinations—the most complete line of fittings ever made to meet every industrial operating requirement.

Russell & Stoll quality adds maximum permanency and protection to your wiring plans. The finest in materials, rugged construction, precision manufacture and exclusive design features, combine to assure ease of installation, reliable operation, low maintenance and long service life.

Write for literature *concerning items in which you have a specific interest.*

RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N. Y. D9

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PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1902

Why the BullDog trademark identifies

Reprints of this thoroughbred bulldog, by the famous artist Durenceau, will be sent upon request. No cost or obligation. Address: BullDog Electric Products Company, Dept. EC23, Detroit 32, Michigan.

the best in electrical equipment

If there is one thing which distinguishes BullDog electrical distribution equipment, it is the unmistakable evidence of the *thoroughbred.*

This goes far beyond merely competent product performance. It touches every phase of the product . . . its appearance, its economy, its ease of handling, its durability, its operating convenience.

Because of this emphasis on total product excellence, BullDog products stand apart. In BullDog Safety Switches, Pushmatic Electri-Centers, Panelboards, Trol-E-Duct, BUStribution Duct, and all others, you see the evidence of the product thoroughbred. Through *integrated design,* all components of each BullDog product work together in perfect harmony . . . for the fullest efficiency, performance, usefulness, economy and long life.

Keep these things in mind when you specify or buy electrical distribution equipment. Look for the BullDog symbol on the products you buy. Our adherence for 50 years to this manufacturing ideal makes BullDog equipment, by all odds, your finest buy.

* * *

For on-the-job assistance in planning your electrical distribution systems, call in a BullDog Field Engineer.

BULLDOG

ELECTRIC PRODUCTS COMPANY

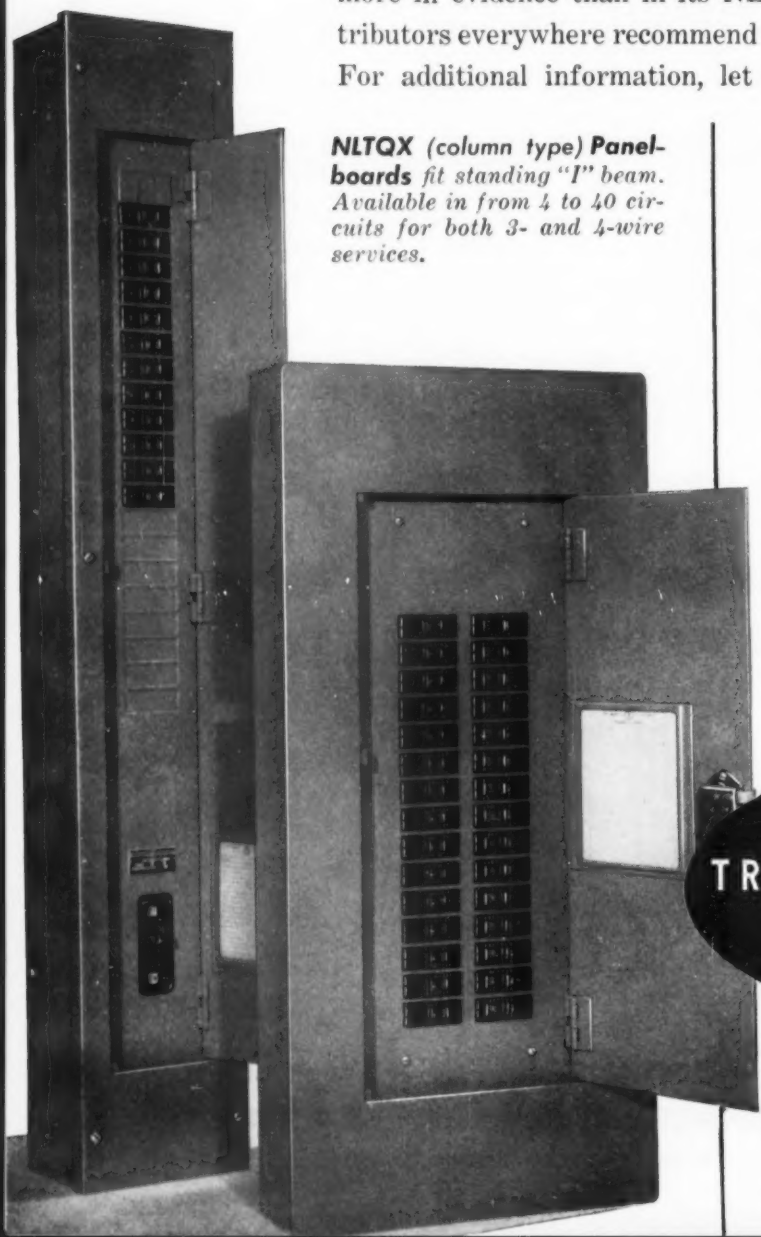
Detroit 32, Michigan

THOROUGHBRED IN ELECTRICAL EQUIPMENT

PICK TRUMBULL NLTQ LIGHTING PANELBOARDS

..for more Convenience in less space with maximum protection and flexibility for future needs

Trumbull's fifty-year leadership in panelboards has never been more in evidence than in its NLTQ line. Leading electrical distributors everywhere recommend them and carry complete stocks. For additional information, let us mail you Bulletin TEB-14.



***NLTQX** (column type) **Panelboards** fit standing "I" beam. Available in from 4 to 40 circuits for both 3- and 4-wire services.*

3 WAYS BETTER...

1. Circuit breaker convenience and protection. Type TQL. Quick-make, quick-break. Thermal-magnetic trip, arc-quenching design and trip-free action for top protection. Convenient plug-in design and manual re-set. Equally important, it has a separate trip indicating position.

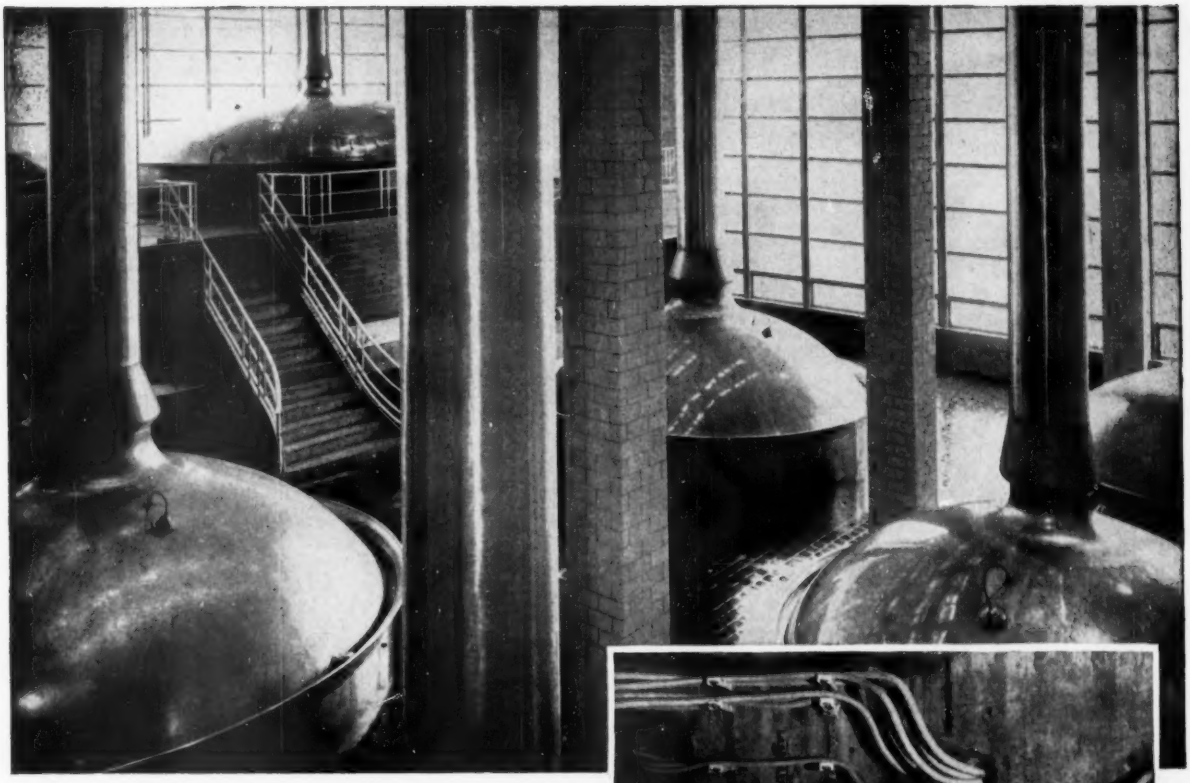
2. Strong compact interiors readily removable for fast installation. Busbars molded in plastisol, and braced against damage from current surges. Run cooler than in open air.

3. Compact boxes, protected fronts. Adequate knockouts and gutters. Front integral with barrier. Breaker knockouts in front panel to provide for future circuits.

TRUMBULL (T) ELECTRIC

DEPARTMENT OF GENERAL ELECTRIC COMPANY
PLAINVILLE, CONN.

***NLTQ Panelboards** available in from 4 to 42 circuits for both 3-wire and 4-wire services with lugs only or Trumbull 50 to 225 ampere breakers in the mains, and TQL 120 volt, 10 to 50 ampere circuit breakers on branches. AC only. Underwriters' Laboratories, Inc. listed.*



they use the best of everything at

Anheuser-Busch

Famous the world over for its fine quality, Budweiser Beer is carefully and expertly brewed from the very choicest ingredients. Of equal importance are the equipment and techniques used; and so, throughout the entire brewing cycle, Anheuser-Busch leaves nothing to chance.

In keeping with this policy, Anheuser-Busch's new brewery at Newark, N. J., uses Okolite-Okoprene cable throughout for primary and distribution feeders. Since an uninterrupted power supply is an important factor in maintaining the famed Budweiser quality, only the best electrical cables will do — Okolite-Okoprene cable.

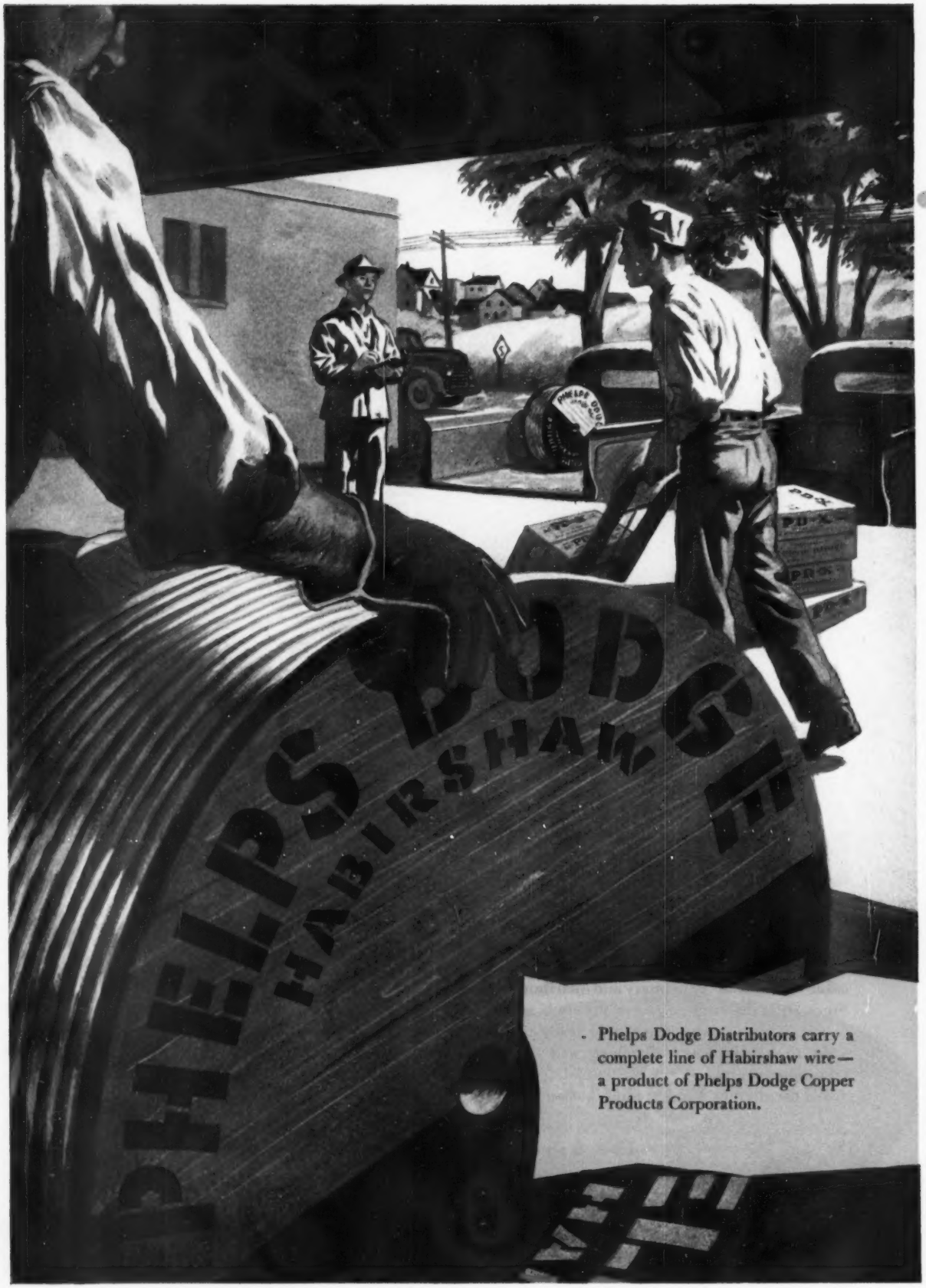
It's the doubly durable combination of Okolite insulation and Okoprene sheath which makes these cables the No. 1 choice for electrical circuits which must not fail. The Okolite insulation provides maximum dielectric strength; the Okoprene sheath is resistant to moisture, heat, sunlight, weather, and most oils, acids and alkalies. Together, insulation and sheath applied by Okonite's strip process provide the circuit security which cannot be obtained by conventional methods of cable manufacture.

The research and engineering which go into all Okonite cables, the extremely high test voltages, the unusual and exclusive manufacturing techniques, will interest every engineer. You'll find it all in Bulletin EC-1053, The Okonite Company, Passaic, N. J.

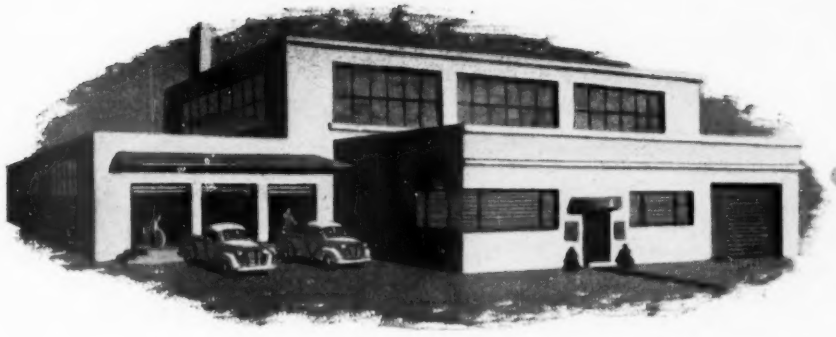
The best cable is your best policy

OKONITE — SINCE 1878 — *insulated wires and cables*

1109



Phelps Dodge Distributors carry a complete line of Habirshaw wire—a product of Phelps Dodge Copper Products Corporation.



SEE YOUR PHELPS DODGE DISTRIBUTOR FOR

QUALITY and SERVICE

YOU CAN COUNT ON!

On every electrical wiring job you can depend on your Phelps Dodge distributor to help you speed job completion—get full job profit.

Not only does he carry the highest quality materials, but his broad background of experience offers invaluable aid in job planning and materials specifications.

Today, more than ever, it pays to see your Phelps Dodge distributor!

PHELPS DODGE COPPER PRODUCTS CORPORATION

WIRE BY PHELPS DODGE MEANS WIRED FOR LIFE!

NEW

Thermalite OVERLOAD INDICATOR

. . . gives you today's biggest value in overload protection

Spots overloads quickly . . . But it won't interrupt service

Here's real ease in overload detection. Check the brilliant light of the *Thermalite* overload indicator right from your service truck. It's visible from hundreds of feet away to keep you posted on load conditions in hard-to-get-at locations.

The *Thermalite* overload indicator shows you when your transformer is overloaded, but it won't interrupt service. That means you can schedule transformer replacements or load rearrangements during daylight hours . . . and do away with costly emergency measures.

The *Thermalite* overload indicator will save you hundreds of hours of expensive surveys. It eliminates the need for keeping countless records, too. It will pay for itself quickly in transformer utilization and longer transformer life expectancy. A-3843

Thermalite is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

The *Thermalite* indicator is available on distribution transformers 100 kva and smaller, 15 kv and below.

KLIXON

TRADE MARK REG U. S. PAT. OFF.

C6360

MOTOR STARTING RELAY LEADS

Since these KLIXON starting relays are used as standard equipment by a great many leading manufacturers of refrigerating units, insulation must be able to withstand both high and low ambient temperatures. Natvar 400 tubing has excellent flexibility and resistance to oil and moisture over a very wide temperature range.

ARE INSULATED AND PROTECTED *with*

NATVAR 400

EXTRUDED PLASTIC TUBING

The KLIXON C6360 is a current type relay which means that the entire motor current flows through it. Therefore the wire in the coil winding is heavy enough to be used for leads, eliminating screw terminals. And since sleeves of Natvar 400 are reasonably low in cost, and are easily slid over the leads, assembly is quicker and less expensive. Also, leads can be color coded, because Natvar 400 is furnished in bright, distinctive colors.

KLIXON Protective devices and controls, manufactured by Spencer Thermostat Division of Metals & Controls Corporation, are used by foremost makers of refrigerating and other electrical equipment to assure safe, continuous operation under all service conditions.

Since reliability of KLIXON devices is essential, only the best materials are used. Natvar 400 extruded plastic tubing has been selected as the most suitable lead insulation for the starting relay shown above because of its excellent physical and electrical properties and its dependable uniformity.

Natvar 400 and other Natvar flexible insulating materials are available either from your wholesalers stock or direct from our own.

Natvar

Natvar Products

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Slot insulation
- Varnished tubing and sleeving
- Varnished identification markers
- Lacquered tubing and sleeving
- Extruded plastic tubing and tape
- Extruded plastic identification markers

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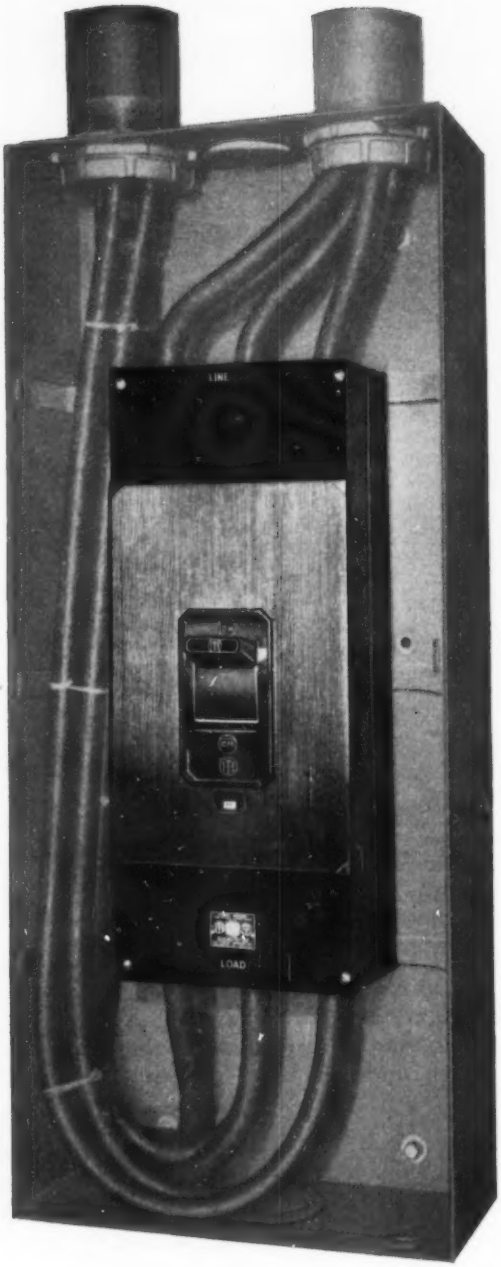
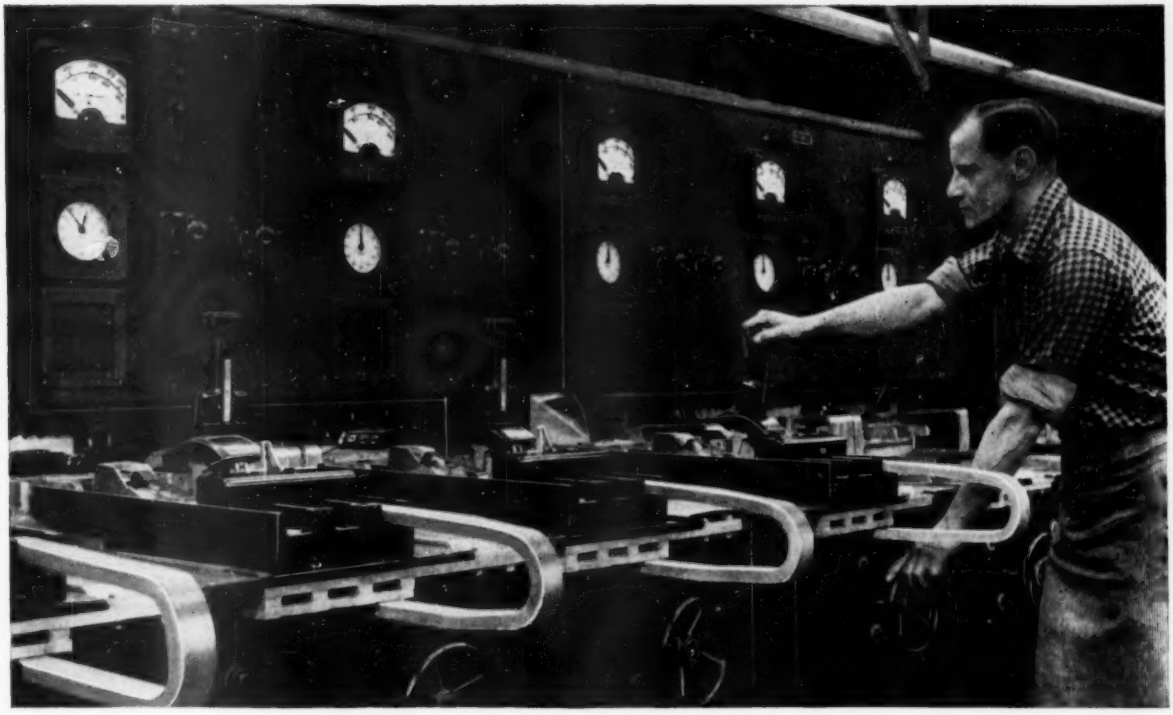


I-T-E MOLDED CASE



Every I-T-E Circuit Breaker is individually tested—*twice*.

I-T-E Circuit Breakers take the guesswork out of circuit protection

When it comes to something as critical as electrical protection, guessing and hoping your protective devices will work can be costly and dangerous. *Pretesting* is the surest way of obtaining complete protection against overload or short circuit conditions.

Outmoded protective devices cannot be pretested on simulated overloads. They would, of course, be destroyed in the process. *Every* I-T-E Circuit Breaker, however, is precisely calibrated and then *twice tested* to assure tripping within certain specified limits. Each tripping element is calibrated so that it will operate within the limits prescribed by the Underwriters' Laboratories. Tests have shown that repeated overloads or short circuits do not change these tripping characteristics.

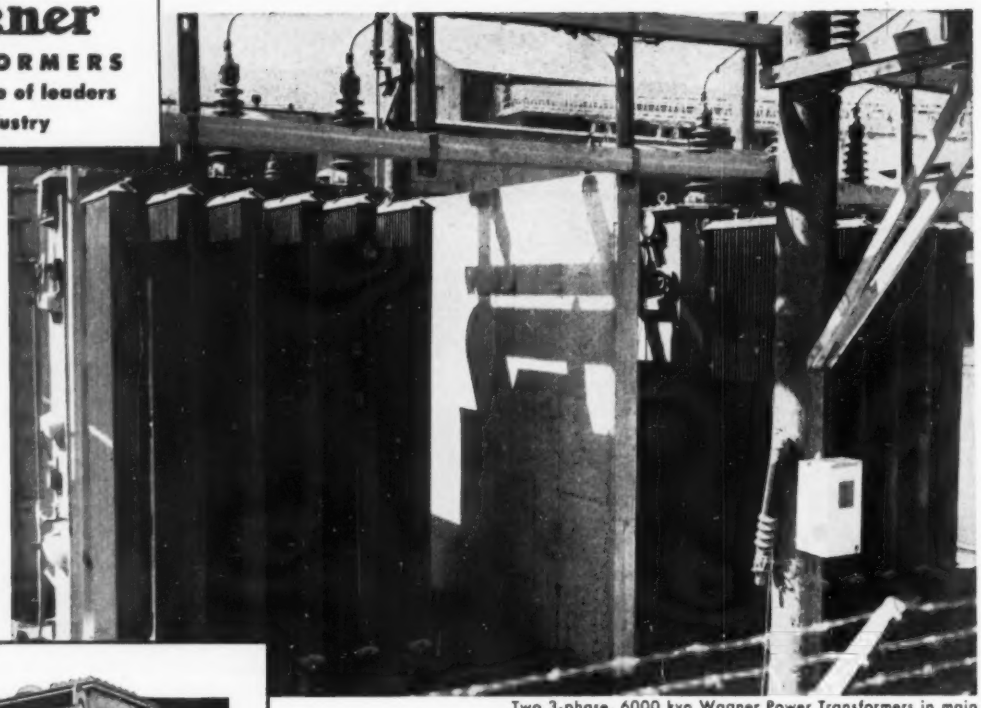
Protective devices are an important and vital part of any plant's power, lighting, and distribution system. So don't skimp on critical electrical protection and regret that you didn't specify the best equipment available.

You specify the best when you specify dependable I-T-E Molded Case Circuit Breakers. Available in four frame sizes, four types of enclosures—from 10 to 600 amperes, up to 600 volts a-c, 250 volts d-c. Check your I-T-E distributor for details.

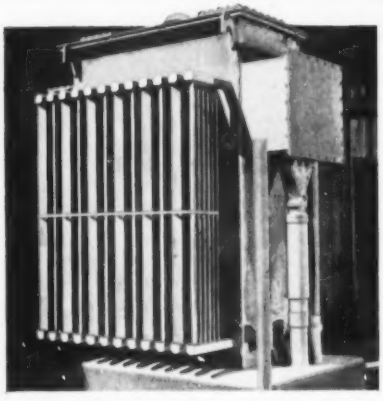
CIRCUIT BREAKERS

I-T-E CIRCUIT BREAKER COMPANY • 19th and Hamilton Streets, Philadelphia 30, Pa.

Wagner
TRANSFORMERS
...the choice of leaders in industry



Two 3-phase, 6000 kva Wagner Power Transformers in main substation — Missouri Portland Cement Company, St. Louis.



ONE OF FIVE Wagner 3-phase, non-inflammable liquid filled unit substation transformers used in this installation. Each transformer is rated 750 kva, 2400 to 480 volts, 60 cycle.

Wagner Power Transformers meet ASA C57 standards

Now, you can simplify your specifications and gain the advantages of improved design at reduced cost by ordering *standardized* Wagner Power Transformers. Wagner Transformers meet all ASA C57 standards for voltage ratings, taps, impedances and both standard and optional mechanical features. Get full information from your nearby Wagner engineer, or write us.

Wagner Transformers selected for modernized distribution system in midwest cement plant

The modernized Prospect Hill plant of the Missouri Portland Cement Company provides a fine example of an up to date distribution system in an application where considerable amounts of power are utilized at primary voltages. 12,000 kva of transformer capacity was required for connected and demand loads, with provisions for a 33 percent increase in capacity for future expansion.

Two Wagner 3-phase power transformers, each rated 6000 kva, with an ultimate of 8000 kva to be obtained with the addition of cooling fans, were used to meet this requirement for the main substation.

The distribution system uses five 750 kva unit substations, each located as close as possible to the load centers they serve. These substations are powered by 3-phase Wagner unit substation transformers, each with identical specifications.

Wagner transformers were chosen for this installation, as they are for a great many industrial and power company installations, because of their ability to give continuous service over unusually long periods of time. Consult a Wagner engineer on your next transformer installation, or write for Bulletins TU-180 and TU-181 for full information.

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...at no extra cost!

SPANGLEAM —an all new product, inside and outside!

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SPANGLEAM —tops in the field!

- easier to cut
- easier to bend
- faster to install
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- lightweight
- strong
- permanent

SPANGLEAM —available immediately in the full range of six sizes:

½", ¾", 1", 1¼", 1½", and 2"

Find out how SPANGLEAM can help you—

- give you a better installation
- make your work easier
- build profits

See your distributor . . . he has SPANGLEAM *in stock.*

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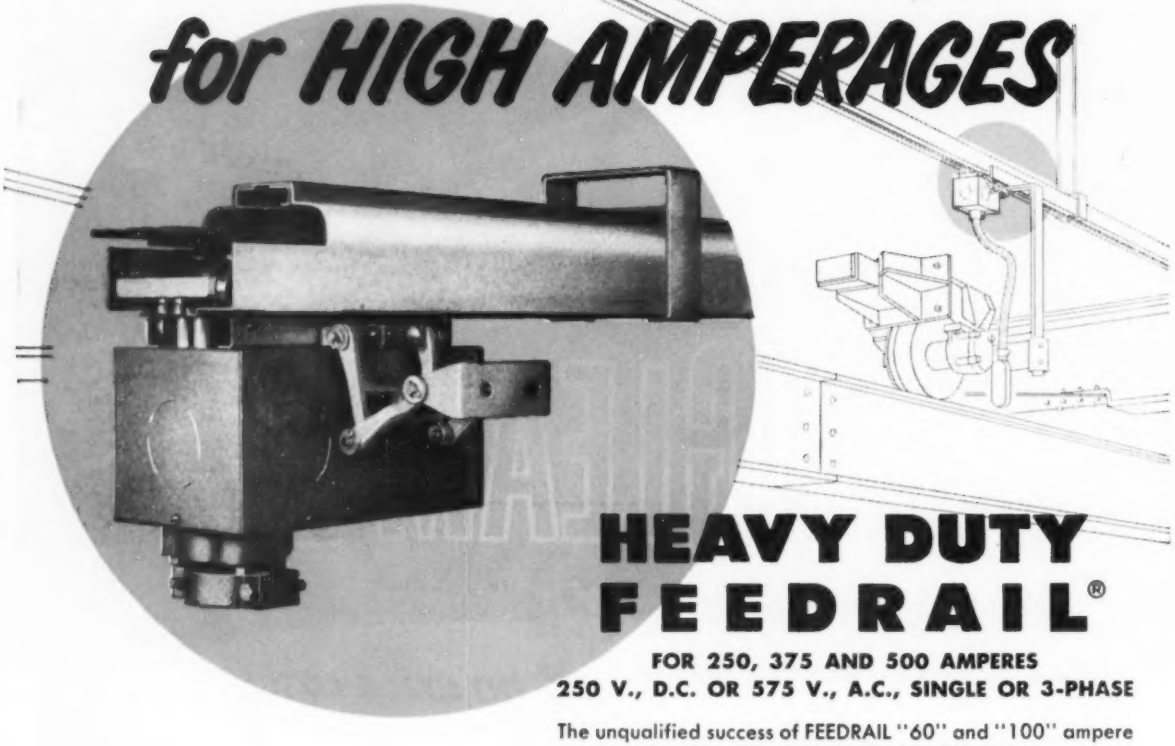
NOW—a completely standardized mobile electrification system for HIGH AMPERAGES



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FOR 250, 375 AND 500 AMPERES
250 V., D.C. OR 575 V., A.C., SINGLE OR 3-PHASE

The unqualified success of FEEDRAIL "60" and "100" ampere systems of mobile electrical distribution has led to many requests for the same system in higher amperages.

These were formerly handled on a "special order" basis. Now, as the result of years of satisfactory service and the heavy demand, 250, 375 and 500 ampere "Heavy Duty" Systems have been made a part of the regular Feedrail line. They are available in standardized track sections, trolleys and accessories.

"HEAVY DUTY" FEEDRAIL is not an adaptation of a lighter capacity system. Every one of its standardized components is designed and proportioned expressly for high amperage and heavy duty service.

Existing applications include freight car icing machines — big tonnage hoists and cranes — large machine tools, etc.

Sold by leading electrical distributors

HEAVY DUTY FEEDRAIL FEATURES

MAXIMUM SAFETY—*Enclosed conductors eliminate dangers of exposed wiring.*

EASE OF INSTALLATION—*Standardized units fit together easily. No special tools are needed.*

ADAPTABILITY—*Easy to extend, modify or move reusing all components of existing system.*

MOBILITY — *Trolley power outlets move with the electrical load.*

LOW MAINTENANCE—*Simple periodic cleaning and lubrication is all that's needed.*

52-5 Rev.

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SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

PROSPERITY IN THE USA: How Wealthy Are We?

Again, how prosperous *are* the people of the United States?

This is the third of a series of messages devoted to this crucially important and much-debated question. The first two messages dealt with what has been happening to our national income, both in terms of its growth and how it is divided among individuals.

This third message deals with what has been happening to the resources – factories, farms, mines, and equipment of all kinds – out of which income is created. It deals with what economists call our wealth.

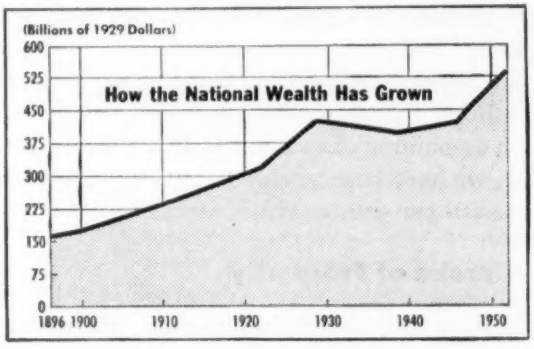
It is possible for a nation to enjoy apparent prosperity for a time by rapidly exhausting its resources. But to sustain prosperity over the long pull a nation must see that its wealth is not dissipated. Hence what is happening to our wealth now is a harbinger of what is going to happen to our prosperity later on.

How Wealth is Measured

It is often asserted that the most vital element in a nation's wealth is its people. There is a lot in this idea. For example, the full value of a country's hospital and surgical equipment depends on its physicians and their skill in handling the equipment.

However, no one has ever devised a satisfactory way to put a value on human beings. So people are omitted from calculations of national wealth. So, too, is military equipment. It is regarded as basically destructive and hence not a real addition to wealth. Otherwise, the wealth of a nation is calculated in terms of the dollar value of its physical resources.

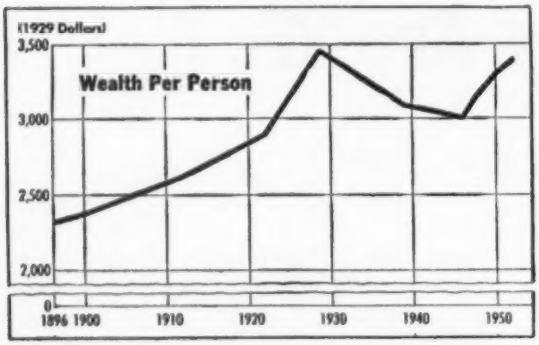
The following chart shows the wealth of the U.S.A. at various intervals during the past 50 years. For the period through 1948 the figures come from a pioneering study by Raymond Goldsmith of the National Bureau of Economic Research, which is widely regarded as the foremost organization in its field. The figures since 1948 are estimated. To remove the effect of price changes, all of the wealth figures are calculated in 1929 prices.



From this chart one fact stands out clearly. It is that since 1929 our national wealth has not been increasing as steadily as it did during

earlier periods. Indeed, in 1946 our total national wealth was actually less than it was in 1929. Only in the last six years have we been able to make any consistent additions.

Even these gains are less impressive when the growth in our population is taken into account, as illustrated by the following chart.



This chart makes it clear that when the nation's wealth is divided by the population, we are slightly worse off per person today than we were in 1929. This is the case in spite of the large additions to our national wealth since 1946.

Depression and war are the two principal reasons we have made no progress in increasing our wealth per person since the 1920s. The depression brought mass unemployment and greatly reduced production which ruled out any increase in wealth. During World War II and again during the post-Korean mobilization program, U.S. production has reached new peaks. But a considerable portion of this record breaking output has been in the form of military equipment, which is not included in an accounting of national wealth. Consequently, we have been unable to regain the level of wealth per person which we had in 1929.

A Brake of Prosperity

What does this failure to raise our wealth per person mean? It means that we have fewer resources with which to create income for each individual. It means that we have made no progress in the crucial task of assuring future increases in prosperity.

As the second editorial in this series demonstrated, we have gone so far in equalizing individual incomes that "the possibilities of increasing the income of the rest of the people by 'soaking the rich' have largely disappeared." From now on the only promising way to increase our individual incomes is to increase our national earning power.

During the past four years it has taken about $3.60 of national wealth to yield $1 of income after taxes. This is a low figure for the wealth needed. Prior to World War II there were long periods when it took at least $5 of national wealth to produce $1 of national income. The experts in this field are by no means certain that it will not again take $5 rather than $3.60 of wealth to increase income by $1.

But let us assume that $3.60 of wealth will suffice to provide $1 of income in the years ahead. If by 1960—seven years from now—the income of the average American is to be increased from about $1490, where it stands at present, to $2000, we must add $310 billion to the national wealth. This is nearly three times as much as we have added to our wealth since the end of World War II, seven years ago.

Because we have made large additions to our productive equipment in recent years, fears are frequently expressed that we shall soon be plagued by an excess of such equipment. But the facts about our national wealth do not support this conclusion. They indicate that we still have ahead of us a tremendous job of increasing our resources if the American standard of living is again to resume the steady climb which was interrupted by depression and war.

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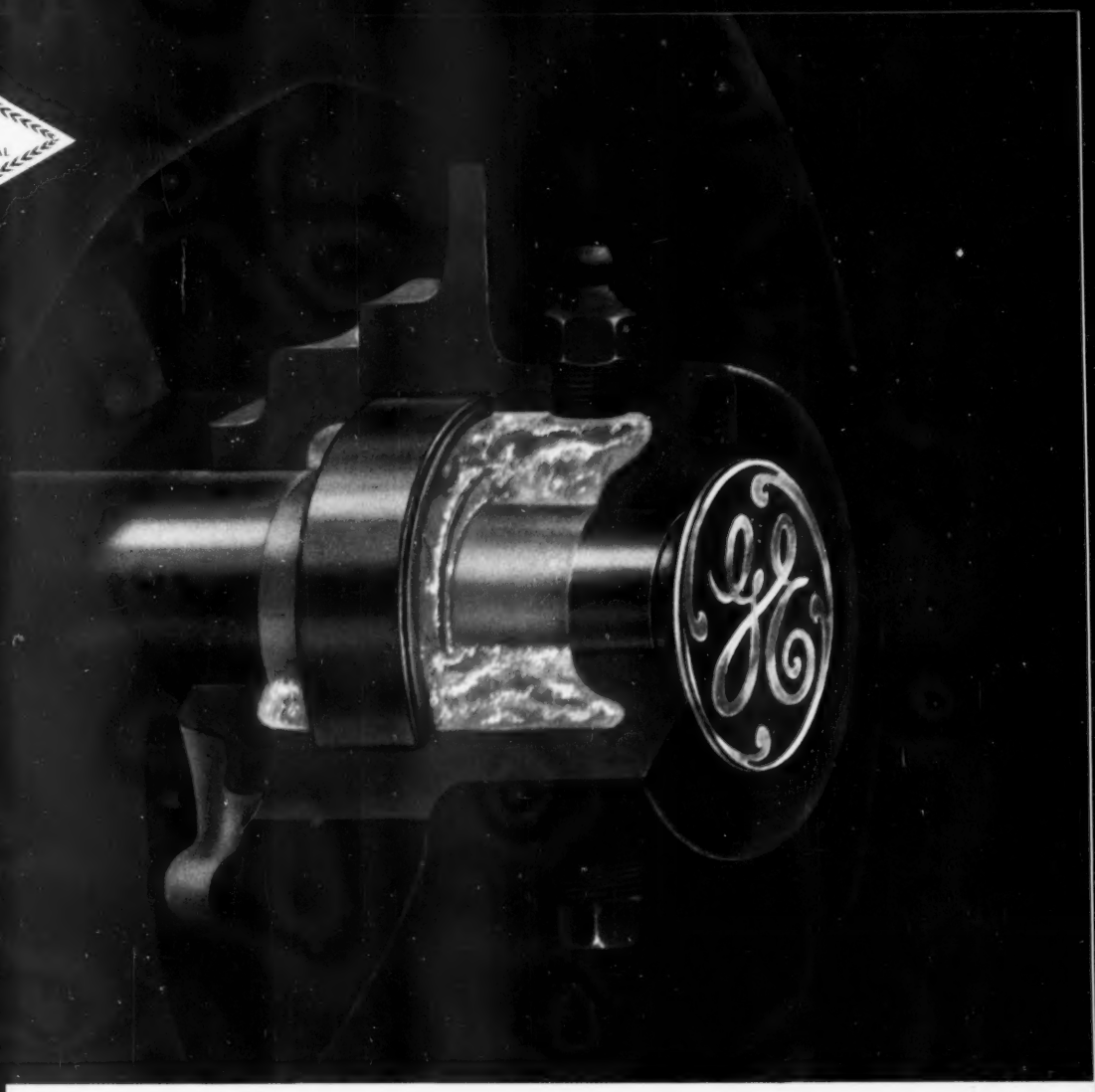
YEARS OF ELECTRICAL PROGRESS



These bearings last longer than life . . . grease life

G-E TRI-CLAD MOTORS LAST LONGER

ALL GREASE LIFE IS LIMITED. The best known greases dry out in time. This may be six months, seven years, or longer, depending on motor application.

SOME MOTORS ARE USELESS WHEN GREASE DRIES OUT. They can't be regreased, you lose production time . . . because your maintenance man is "sealed out."

BUT GREASE LIFE NEED NOT LIMIT MOTOR LIFE. Tri-Clad motors give long life without relubrication, plus provision for adding new grease when necessary.

ADDED GREASE IS USEFUL GREASE. Relubrication puts fresh grease in storage in bearing housing . . . as motor operates, grease oils migrate to bearing as needed.

TRI-CLAD MOTOR BEARING IS EASIEST TO REGREASE. Do it on the job, with motor running . . . no dismantling . . . no trip to a service shop.

TRI-CLAD MOTOR BEARING IS BETTER PROTECTED. Completely enclosed housing has *longer seals* to keep dirt out, *larger grease supply*, and *scientific design* for continual grease migration.

THIS PRACTICAL BEARING DESIGN is one more reason why G-E Tri-Clad motors give better service . . . added life. Order through your nearby G-E Apparatus Sales Office or authorized G-E agent or distributor. General Electric Company, Schenectady 5, N. Y.

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EASY TO INSTALL, G-E L-69 FLOODLIGHTS DOUBLE USE OF RECREATION AREA.

G-E L-69 floodlights for lower installation costs

EASY INSTALLATION. You save money by saving time when you install competitively priced G-E L-69 1500W Floodlights. From the simple two-bolt mounting to the convenient beam sight for fast daylight aiming, the lightweight G-E L-69 is designed so that it will cut your costs by simplifying your installation. On many installations, the floodlight can even be aimed while the pole is on the ground, with easy to read horizontal and vertical degree scales.

And with the G-E L-69, you do a quality lighting job that soon pays off in more lighting business for you.

ECONOMICAL MAINTENANCE. Built in wrench type handle on the G-E L-69 completely eliminates the need for tools. Both relamping and cleaning are fast and easy, and the G E L 69 delivers more light per unit, more light per watt, than any other comparable lighting unit obtainable anywhere.

PROMPT DELIVERY. You can get the G-E L-69 right out of stock at shipping points throughout the country. Whatever your lighting requirements, there's a light in G.E.'s complete and comprehensive line to precisely fit your particular needs. And if you need help, you can get it from G.E.'s staff of lighting specialists.

USEFUL INFORMATION is yours for the asking. NEMA approved floodlighting plans for all sports are contained in GET-1284; effective industrial uses are explained in GEA-3640D; and Bulletins GEC-533B and GEC-919 give complete details on the L-69 sports and area floodlight. Just write Section 451-179, General Electric Co., Schenectady 5, New York.

NO TOOLS required for initial positioning or maintenance, with built in wrench-type handle. Large area clamping action holds against vibration.

EASY AIMING possible even during daylight with G-E L-69's convenient beam sight . . . puts the light in the right place, saves time.

NO BREAKAGE with spun-on, impact resisting tempered plate glass, which won't break if struck by ball, and keeps out water, dirt, insects.

EASY CLEANING and relamping! Just flick hand toggle latches, clamp socket housing to trunnion bracket. Hands are free to service light.

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RACO'S BLOS...

the one-screw box that's 6 ways better!

1. The heavy embossed shoulder on the plaster ear insures greater strength.
2. Slot and position of screw allow maximum adjustment — 0" to ¾".
3. Long, deep embosses on body hold ear rigid and provide a perfect channel.
4. Cable rests on these smooth embossments, securely held, well protected.
5. Insert screwdriver in these angled slots and one natural twist removes KO.
6. Clamp screws emerge from beveled side so box can be mounted on a flat surface.

This RACO one-screw, beveled loom box provides the answer to the electrician's need for a one-screw box that has a plaster ear with the strength to hold permanently, that can be guided evenly into place, and has up to ¾" of adjustment. What's more, the clamp screw emerges on the beveled side of the BLOS and allows it to be mounted on a flat surface. Here's another example of why RACO leads the field... from coast to coast.

You can always rely on RACO

RACO

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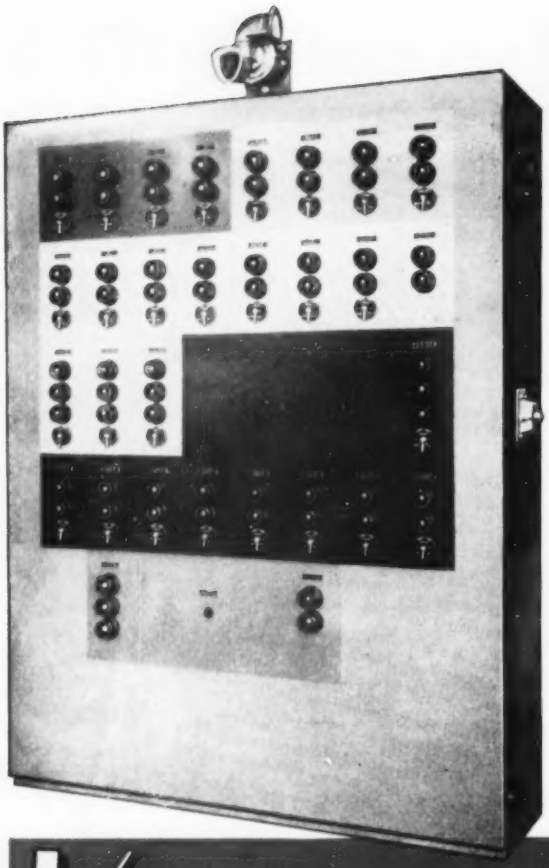
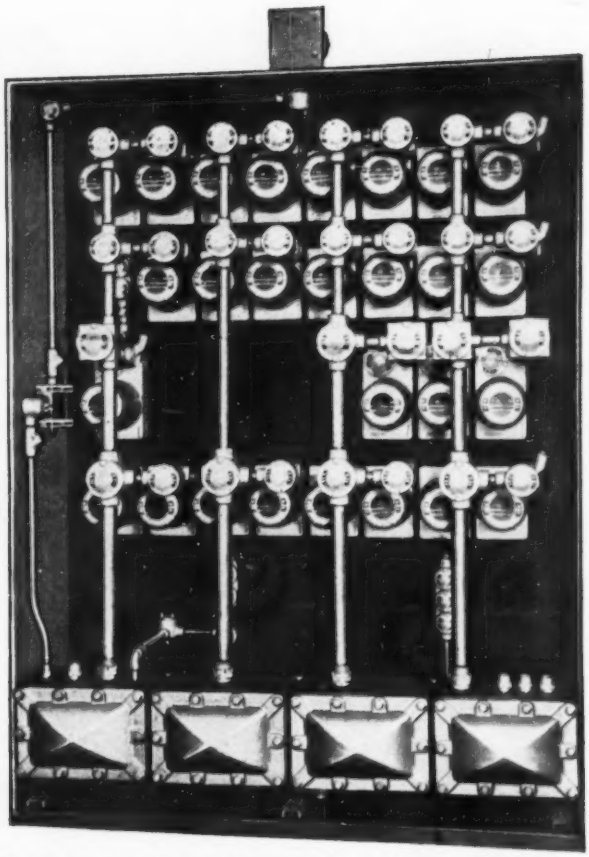
"A BOX FOR EVERY NEED"





Front and rear views of alarm panel containing 27 Type EKP explosion-proof Visularms built for a chemical plant.

Visularm CONDULETS®

safeguard continuous production by instant warning of abnormal conditions

1. **Pilot lights** give visual indications of normal and abnormal temperature, pressure liquid level, speed, load or other conditions.
2. **Bell or howler** can be used to give an audible signal. A single bell or howler can serve any number of *Visularms.*
3. **Flashing light** instantly directs attention to the proper control station.
4. **Reset-Test Switch.** "Reset" position silences audible signal and changes flashing light to steady until normal operation is restored. "Test" position permits periodic check of each element in the *Visularm.*
5. **Compact and easy to install.** Occupies little space on the control panel. Only requires round drilled holes.
6. **Accessible** . . . . all actuating devices are on a factory-wired, jack-mounted plate which can be quickly removed for servicing and a spare can be inserted to maintain operation.
7. **Two-light and three-light** *Visularms* are available; any number can be mounted in either vertical or horizontal rows on a control panel. Type EKP *Visularm* is explosion-proof and Type KP *Visularm* is dust-tight and weather-resistant.

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Junction boxes, switch panels, conduit and other fixtures were anchored to concrete with DRIVE-IT in the Native Service Hospital, Anchorage, Alaska. Electric Smith Co. of Spokane, Washington, the electrical contractor on this job, chose DRIVE-IT as it is the fastest, most economical method of fastening to concrete or steel.

Worker using DRIVE IT 300 to secure electric control panel to concrete wall.

split-second fastening to concrete steel

Drive-It uses a small powder load to drive hardened steel pins into concrete or steel. No power lines! No drilling!

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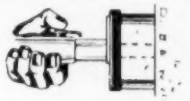
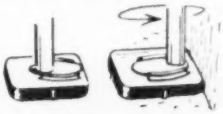
DRIVE-IT, the *first* powder actuated tool approved by Underwriters' Laboratory.

DRIVE-IT cannot be discharged accidentally due to the push and turn sequence. This, plus the large safety pad makes *DRIVE-IT* triple safe.



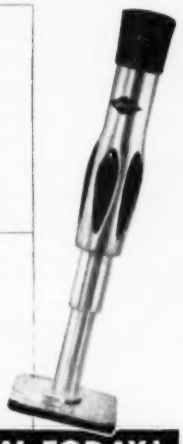
Exclusive Automatic Barrel Extension for fastenings inside junction boxes or other recesses.

DRIVE-IT is the only powder-actuated tool which requires but one standard power load regardless of penetration desired.



Exclusive Swivel Safety Pad easily rotated for getting into close quarter work.

DRIVE-IT "300", lowest cost fastening tool. Low original cost and low operating cost.



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Whether it's secondary and service drop cable or weatherproof wire for primary circuits, you get a host of cost advantages with Rome Aluminum.

Low installation and maintenance costs

You can string longer spans with fewer poles because its mechanical design and light weight reduce sag tendencies. It gives you greater protection against wind and ice loading. It reduces tree trimming and cuts labor costs during installation.

You need fewer accessories for secondary and service drop cables because of Rome Aluminum's Triplex construction. This also assures a neater, cleaner installation.

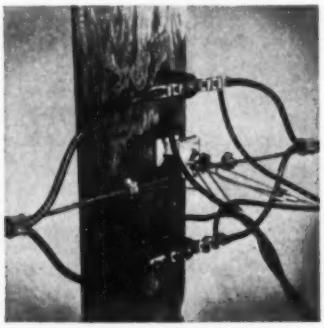
Maintenance costs are down, too. Conductors are easily accessible because Rome Triplex requires no common covering.

Long service life

And you can count on long service life. Aluminum itself it a long-life conductor material. RoPrene (Neoprene) and RoLene (polyethylene) insulation have exceptional resistance to weather and abrasion. Replacement is minimized. There are no braids to rot or festoon.

Take advantage of the savings inherent with aluminum itself . . . and the results of years of exhaustive research and testing by technically skilled, progressive Rome engineers. Ask your Rome salesman about Rome Aluminum on his next visit.

Light weight of Rome Aluminum Triplex permits easy installation, cuts labor costs, reduces sag, minimizes ice loading.

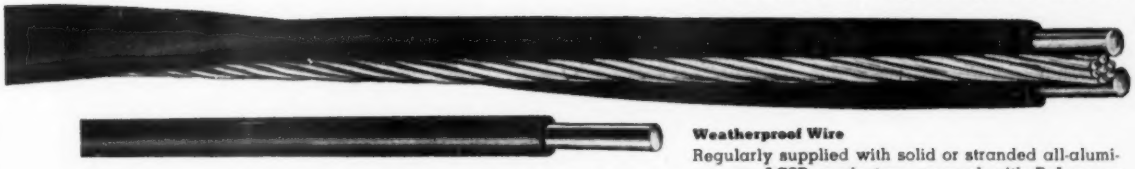


Here is a typical service tap connection at the pole . . . only one of several types of connections which can be made.

Dead end formed around bare neutral messenger of Rome Aluminum Triplex make house connection. Also meets industry requirements.

Triplex Self-supporting Secondary and Service Drop Cable

Regularly supplied with stranded or solid all-aluminum power conductors, insulated with RoPrene (Neoprene) and ACSR or other suitable bare neutral messenger. All-aluminum, copper or copperweld messengers are also available. RoLene (polyethylene) insulation can be supplied in place of RoPrene.



Weatherproof Wire

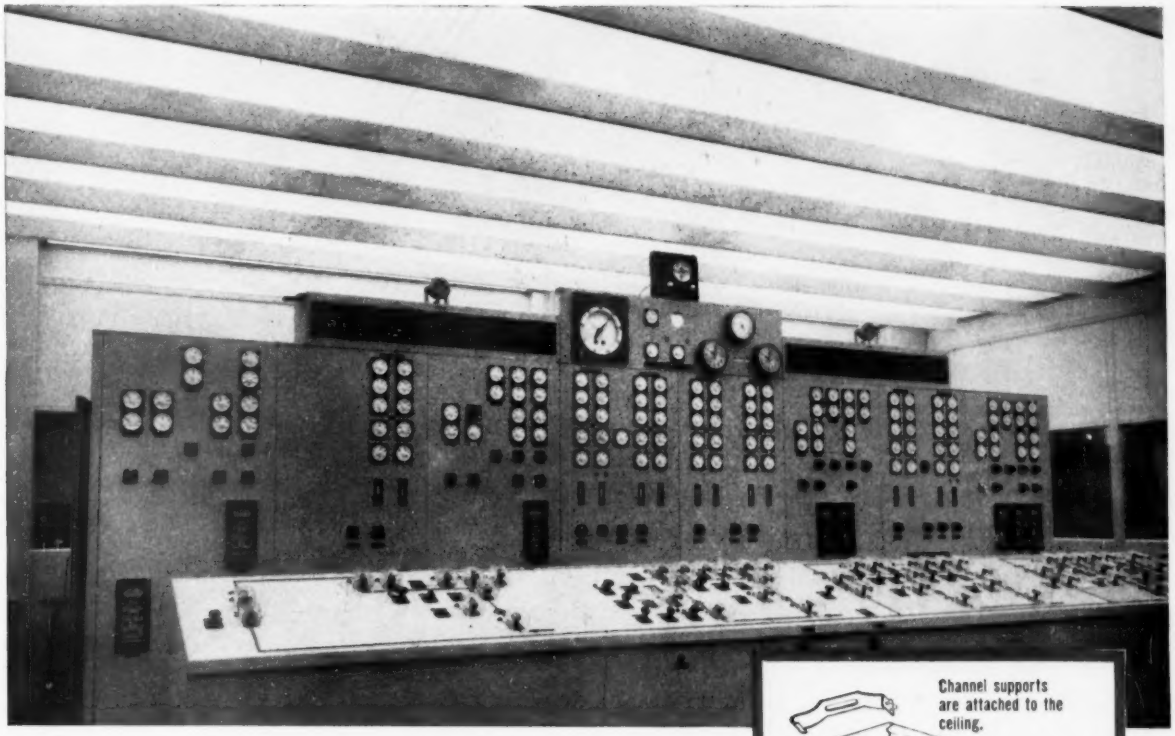
Regularly supplied with solid or stranded all-aluminum or ACSR conductors, covered with RoLene or RoPrene. Conventional URC triple braid covering can be supplied.

It Costs Less to Buy the Best

Rome ALUMINUM

ROME CABLE CORPORATION, ROME, N.Y., AND TORRANCE, CALIF.

SIGNAL DELUXE REVERSIBLE WINDOW FAN
Another ALL NEW center of attraction...
...in the respected SIGNAL line
SIGNAL ELECTRIC MFG. CO., MENOMINEE, MICHIGAN



New and Profitable Business for Electrical Contractors . . .

INSTALLING WAKEFIELD "THREE-WAY" CEILINGS...

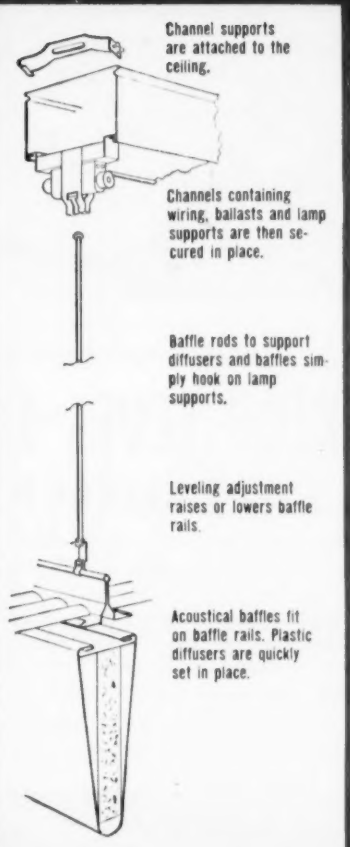
1. With the Wakefield Ceiling, contractors are given an opportunity to sell and install entire ceilings instead of just fixtures.

2. The Wakefield luminous ceiling may include acoustical baffles and can be used as a diffuser for air conditioning, yet it is always installed in its entirety by an electrical contractor licensed by Wakefield.

3. The Wakefield Ceiling is an engineered, standardized "package" shipped to the job with simple installation steps clearly outlined.

4. Many Wakefield Ceiling installations have been made with labor costs running no more than 10% to 15% of total installed cost.

5. Qualified contractors are invited to become Wakefield-licensed installers. Wakefield will furnish a factory man for on-the-job training in the early stages. Write to The F. W. Wakefield Brass Company, Vermilion, Ohio.


Channel supports are attached to the ceiling.
Channels containing wiring, ballasts and lamp supports are then secured in place.
Baffle rods to support diffusers and baffles simply hook on lamp supports.
Leveling adjustment raises or lowers baffle rails.
Acoustical baffles fit on baffle rails. Plastic diffusers are quickly set in place.

THE F. W. Wakefield BRASS COMPANY
Vermilion, Ohio

INSTALLATION: Our Lady of Mercy School, East Greenwich, Rhode Island.
ARCHITECT: Joseph M. Mosher, Providence, Rhode Island.
SUPPLIER: Graybar Electric Co., Providence, Rhode Island.
ROOM SHOWN: Second grade classroom.
AREA: 24'-0" x 30'-0".
CEILING HEIGHT: 10'-6".
FINISHES: Ceiling, off-white acoustic tile; walls, light grey; floor, brown tile; chalkboards, black; woodwork and desktops, light natural wood.
FIXTURES: Litecontrol No. 4624 mounted on 8" stems. Cutoff 38° crosswise, 26° lengthwise. Standard cool white 40-watt lamps.
WATTS PER SQUARE FOOT: 1.7.
INTENSITY: At desktop level, 30 footcandles in service.

LOW BUDGET SCHOOL WITH

HIGH LEVEL LIGHTING

. . . by LITECONTROL

Built with little more than a shoestring through the efforts of Father Brady, the curate, this Parochial School contains many interesting cost-cutting features. One of the best is LITECONTROL'S attractive lighting fixture No. 4624.

Extremely efficient (86%), it combines low initial cost with unusually easy maintenance.

Curved metal side panels are illuminated by reflected light from ceiling and walls, thus showing a luminous appearance and practically eliminating contrast between fixtures and ceiling. Smooth curved sides and lamps are cleaned from above with just one pass of a tank type vacuum cleaner. Baffles are hinged from either side and may be installed or removed without use of tools.

Another example of the "More Light and Looks for Your Money" you get with *every* LITECONTROL Fixture. It will pay you to know the *complete* line. See your local LITECONTROL man.

LITECONTROL *Fixtures*

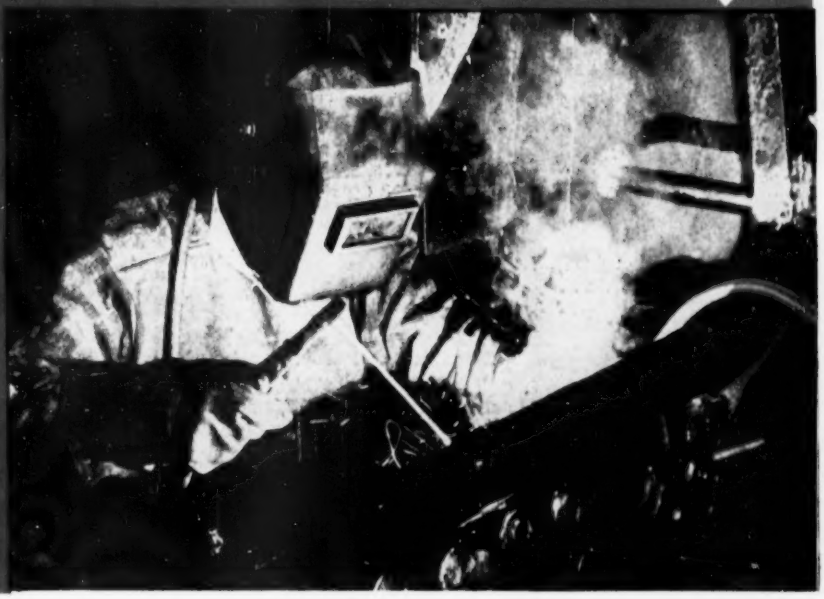
LITECONTROL CORPORATION
36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

TIREX Welding Cable means More Efficiency

for

THREE GOOD REASONS



1 **Excellent Flexibility:** TIREX Welding Cables have a single conductor composed of many hundreds of specially-twisted copper strands. The twisted copper strands give exceptional flexibility that lessens drag and wrist fatigue. TIREX Welding Cables will not snarl or kink.

2 **Strips Clean:** Between conductor and jacket a specially selected paper separator is used to assure clean, fast stripping.

3 **Longer-Life:** The famous neoprene armor is **cured in lead.** This means extra protection against tear and abrasion. TIREX Welding Cables offer excellent resistance to damage by oil, chemicals, moisture, and flame.

These are the features that can mean greater production, more finished work, and lower operating costs on all your electrical welding jobs. TIREX Welding Cables come in sizes ranging from No. 8 A.W.G. with 420 strands, to 1,000,000 C.M. with 25,270 strands. For more complete information on your specific welding problem call your nearest Simplex representative or write to us in care of the address below.

SIMPLEX-TIREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

THE MOST COMPLETE LINE OF QUALITY

Switches

no. 5001
10A.-125V.T. 5A.-250V.

no. 5212
10A.-125V.T. 5A.-250V.

no. 1021
5A.-250V. 10A.-125V.

no. 1331
5A.-250V. 10A.-125V.

no. 260
10A.-125V.T. 5A.-250V.

no. 5231
5A.-250V. 10A.-125V.T.

for industrial, commercial and residential installation

Leading contractors always specify LEVITON for all their jobs – in the vast range of LEVITON switches – some of which are shown here – they always find the switch that exactly fits their job requirements. No need to ever improvise.

You'll like these LEVITON *features too:*

- Sturdy bakelite base and rivetted construction for easier, surer handling.
- Large, accessible binding-head screws for speedier wiring.
- Accurately built mechanisms of durable materials for long life and trouble-free performance.

There are LEVITON switches to meet U.L. standards, R.E.A., Federal, and C.S.A. specifications, T-rated switches, single-pole and 3-way switches, surface mounting switches, and combination devices, in a range of capacities, in brown or ivory.

LEVITON

LEVITON MANUFACTURING COMPANY brooklyn 22, New York

WHEN ORDERING
HIGH VOLTAGE
CABLE SPLICING
MATERIALS SEPARATELY . . .

you're Wasting Time

. . . IF YOU GO
THROUGH ALL OF
THESE STEPS WHEN
ONE WILL DO

1 design the joint

2 figure bill of material

3 issue requisitions to purchasing department

4 find sources of supply for each item

5 secure quotation and delivery on each item

7 receive material and assemble

6 place order for each item

8 issue material to cable splicers

THE G & W SPLICING KIT *is the* TIME SAVING WAY

Simply give us complete cable data and you receive a neat package with adequate quantities of all materials for a properly designed joint.

You save time and money because . . .

No lengthy material specifications are necessary.

Both design and installation methods can be standardized.

All joints are properly designed to industry standards by expert cable engineers.

All splicing materials are purchased from one source.

Each kit packed in convenient size box. Easy to store, identify and handle.

Individual kits issued directly to workmen in original shipping cartons.

Easy to quickly estimate costs for any particular job.

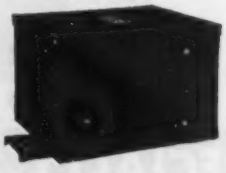
G&W ELECTRIC SPECIALTY COMPANY
7780 DANTE AVENUE • CHICAGO 19, ILLINOIS, U.S.A.
Representatives in principal cities. In Canada, Powerlite Devices, Ltd., Toronto

400 or 1,000-watt millite luminaires, 18′ to 30′.

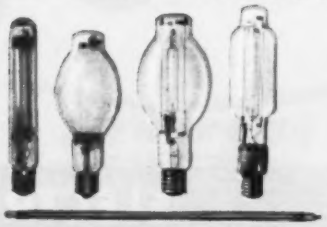
400-watt, lock-lite luminaire, used in machine shop shown above.

3,000-watt mercury luminaire, 40′ and over.

1,000-watt mercury high-bay, 25′ and over.



Complete range of ballasts for high or low-voltage systems.



Complete range of lamps, including new color-corrected J-H1, 400-watt lamp.

More light for 1/3 less cost

with Westinghouse MERCURY lighting

Today's mercury lighting systems produce more light per luminaire than any other lighting system. That's why it's economically practical to step up your lighting standards and still save money.

For example, in the case of this machine shop in California, an engineering cost analysis showed a saving of 30% on initial cost, as compared to other systems considered. Efficiency really improved. Employees go so far as to say, "It's easier to see on the night shift now, than it is on the day shift". Here's evidence that the working area is shadow free.

What's more, maintenance costs are drastically cut with mercury lighting. Less than half as many fixtures to maintain—fewer lamps to replace.

It's important to you to investigate Westinghouse mercury lighting systems. You'll find a complete line for every phase of plant operation: 400, 1,000, 3,000-watt units for low or high-bay areas—open or closed fixtures for clean or dirty locations—low or high-voltage ballasts for any distribution system. Only Westinghouse can furnish you a complete mercury lighting system. Send today for B-4727, "Westinghouse Lighting at Work in Every Industrial Area", Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Penna.

J-04321

YOU CAN BE **SURE**...IF IT'S

Westinghouse

LIGHTING DIVISION

Edgewater Park, Cleveland, Ohio

Model 622 – Ultra-Sensitive Instruments

Portable d-c and a-c thermo instruments for precision measurement of potentials and minute currents in electronics or laboratory research.

Model 901
Portable Test Instruments

Available in d-c, Model 901 –and a-c, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

A-C Clamp Volt-Ammeter

(Model 633, Type VA-1) For convenient and rapid measurement of a-c voltage and current without breaking the circuit. Jaws take insulated or non-insulated conductors up to 2" diameter. Safe, rugged, versatile. Also available as a-c clamp ammeter, without voltage ranges.

Specialized and Multi-purpose

INSTRUMENTS

for

- **RESEARCH**
- **PRODUCTION**
- **MAINTENANCE**

For complex, or just routine measurement jobs, these and other specialized WESTON Instruments save time and assure dependable measurements. For information on the complete line, see your local Weston representative, or write . . . WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

WESTON
Instruments

Sensitive Relays

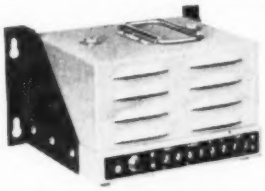
A line of sensitive relays including the Model 705 which provides positive operation at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.

Panel and Switchboard Instruments

A complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including d-c, a-c power frequencies and radio frequency, rectifier types and D.B. meters.

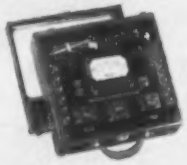
Model 697 Volt-Ohm-Milliammeter

One of a line of pocket-size meters, Model 697 combines a selection of a-c and d-c current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.



Model 1411 Inductronic D-C Amplifier

Stable amplifier provides high degree of resolution even at fractional loads. Reaches steady full scale deflection in a fraction of a second. Interchangeable plug-in range standards for either microamperes or millivolts.



Industrial Circuit Tester – Model 785

A multi-range, multi-purpose, ultra-sensitive analyzer, for laboratory and industrial checking of electrical and electronic circuits. Has 28 practical scale ranges; measures d-c and a-c voltage, d-c and a-c current, and resistance. Accessories available to extend ranges. Compact and portable; furnished in either oak or steel case.

Model 686
Electronic Tube Analyzer

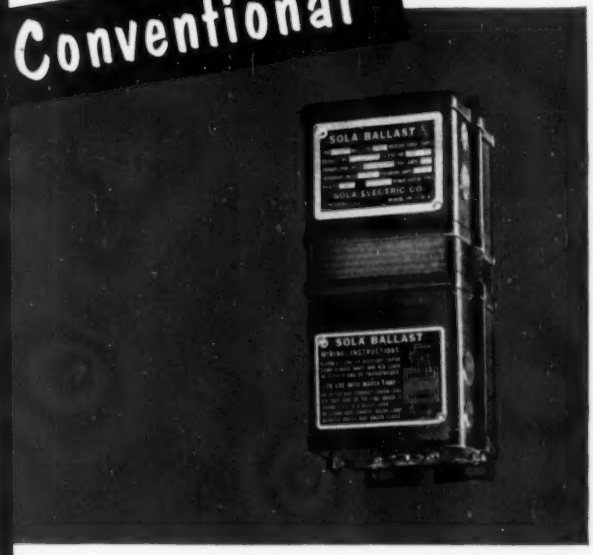
Tests tubes under exact operating potentials. Accurately determines true mutual conductance of all tubes, in accordance with manufacturers' rated operating conditions, or under special operating conditions.

High Frequency Electronic Analyzer
Model 769

A three-in-one instrument providing a self-contained Volt-Ohm-Milliammeter, a high impedance electronic D-C Volt-Ohmmeter, and a probe type Vacuum Tube Voltmeter for use to 300 megacycles. Exceptionally stable and accurate. Has specially designed extremely small RF and D-C probes.

Sola Mercury Vapor Lamp Transformers

Regulated or Conventional



for Indoor Lighting Installations

SOLA CONSTANT WATTAGE BALLASTS . . .

. . . continuously and automatically supply constant wattage within ±2% regardless of line voltage fluctuations as great as ±15%. This patented circuit results in the following advantages:

1. *Eliminates need for primary voltage taps*
2. *Assures positive lamp starting*
3. *Reduces line and lamp starting current surge*
4. *Eliminates voltage-drop lamp outages*
5. *Maintains constant lamp wattage, lamp current and light output*
6. *Extends lamp and transformer life.*

Single-lamp and two-lamp units are available for indoor operation of the 400 watt type H-1 mercury vapor lamps.

SOLA CONVENTIONAL-TYPE BALLASTS . . .

. . . are premium quality, non-regulated auxiliaries at moderate prices. They are designed and produced to the same high standards of quality as the Constant Wattage types.

Typical quality features include: the Sola pressed-in-core construction, leads fastened to sturdy lug straps, not merely coil ends . . . high vacuum varnish impregnation . . . pryout in each end cover exposing a ½" threaded conduit fitting . . . ½" and ¾" knockouts . . . large access panels to roomy wiring compartments.

They are available for single-lamp operation of the 400 watt type H-1 mercury vapor lamps. Three primary voltage taps are provided for proper matching to various line voltages, insuring operation at lamp ratings and resulting in full light output.

Write for complete electrical and mechanical specifications

Regulated Outdoor

Regulated Indoor

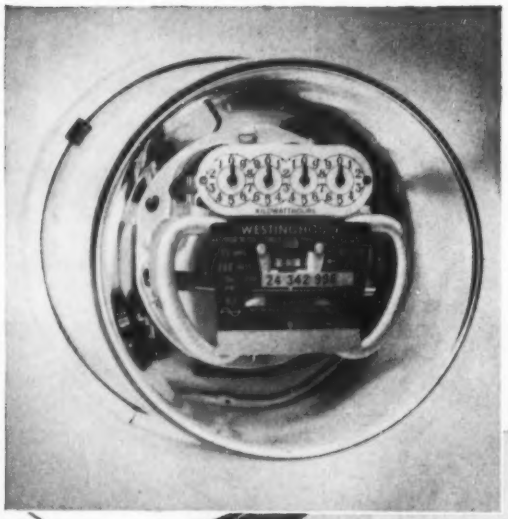
Conventional Indoor

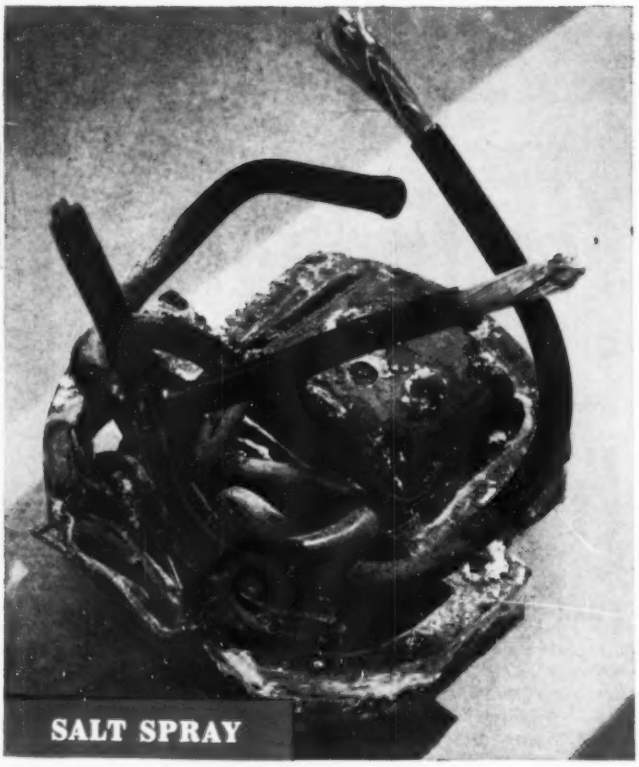
SOLA *Mercury Vapor Lamp* **TRANSFORMERS**

SOLA ELECTRIC CO., 4633 W. 16th Street, Chicago 50 • NEW YORK 10, 103 E. 125th St., Harlem 4-2460
PHILADELPHIA, Commercial Trust Bldg., Rittenhouse 6-0728 • BOSTON, 260 Walnut St., Newtonville, Mass., BEacon 2-7510
CLEVELAND 15, Keith Building

...in the Westinghouse types CA & CS meters

withstand after three





The entire electromagnet was immersed in brine for 3 months. Here it is after being removed. The U·S·S AMPYROL was completely unaffected, and easily withstood the 12,000 volt breakdown test.

AMERICAN STEEL & WIRE DIVISION
USS
TRADE MARKS
AMERICAN ELECTRICAL WIRE AND CABLE
UNITED STATES STEEL

A STANDARD Cable for

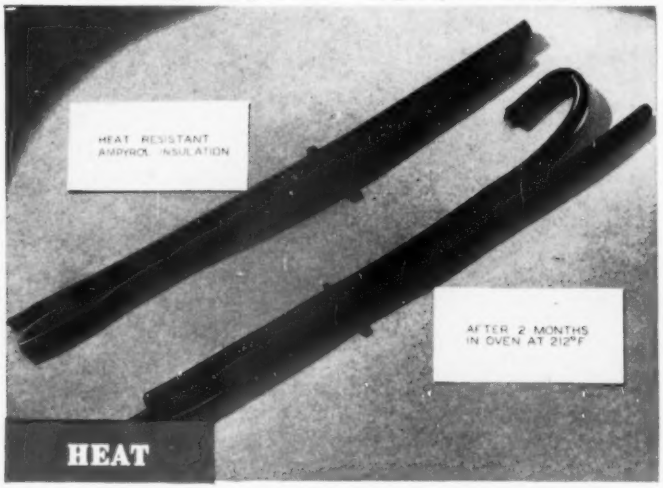
- paper & varnished cambric cables
- asbestos cords and cables
- aerial, underground & submarine cables
- shovel and dredge cables

U·S·S AMERICAN ELECTRICAL

U·S·S Ampyrol coils 12 kv breakdown test months in salt water!

EVERY watt-hour meter is literally a "cash register" for some power company. As such, it must be extremely accurate.

The Westinghouse meter shown here remains accurate for years—mostly because of an engineering program that continually searches for ways to make the meters even *more* accurate while remaining unattended and exposed to the elements for years on end. For example: Westinghouse pioneered the ball and sapphire bearing, and practically eliminated a major source of wear. They even go so far as to *gold plate* every gear in the gear train, so that they will not corrode and slow down the meter.



Two months at 212°F. had no affect on U·S·S AMPYROL. When removed, the insulation passed all physical and electrical tests.

Now, Westinghouse has taken another major step forward in design by switching to U·S·S AMPYROL for the important current winding in these watt-hour meters.

American Steel & Wire engineers worked closely with Westinghouse, and developed a special non-fogging polyvinyl insulation that has excellent electrical and physical properties; yet it will not give off fumes that cloud the meter glass. As part of a rigorous test procedure, Westinghouse engineers immersed the entire electromagnet in a brine solution for 3 months. After removal, the AMPYROL wire easily withstood a 12,000 volt breakdown test. In another test, AMPYROL was held in an oven at 212°F. for 2 months. When removed, it was just as good as new and tested perfectly.

The full range of tests showed that U·S·S AMPYROL would eliminate leakage current due to faulty insulation, thereby assuring long range meter accuracy.

How has this insulation actually stood up in service? Hundreds of thousands of AMPYROL equipped meters are now in service; and the insulation is performing perfectly despite the moisture, industrial fumes, salt air, ultra-violet rays from the sun and extreme heat and cold.

• • •

This is just one of many uses for U·S·S AMPYROL. It is widely used for re-wiring old buildings because the thin jacket allows more wire to be pulled through the same size conduit. AMPYROL is an important part of many machine tools because it strips clean, is available in many brilliant colors to simplify installation, and is unaffected by cutting oils and grease. AMPYROL is even used for exposed electric sign wiring because rain, sun and cold do not affect it.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION
GENERAL OFFICES: CLEVELAND, OHIO

IN THE WEST—COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
IN THE SOUTH—TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

every **SPECIAL Job!**

- oilproof portable cords
- plastic machine tool & building wire
- special purpose cords & cables

WIRE & CABLE

SEND THE COUPON

American Steel & Wire Division
Room EC-23, Rockefeller Building, Cleveland 13, Ohio

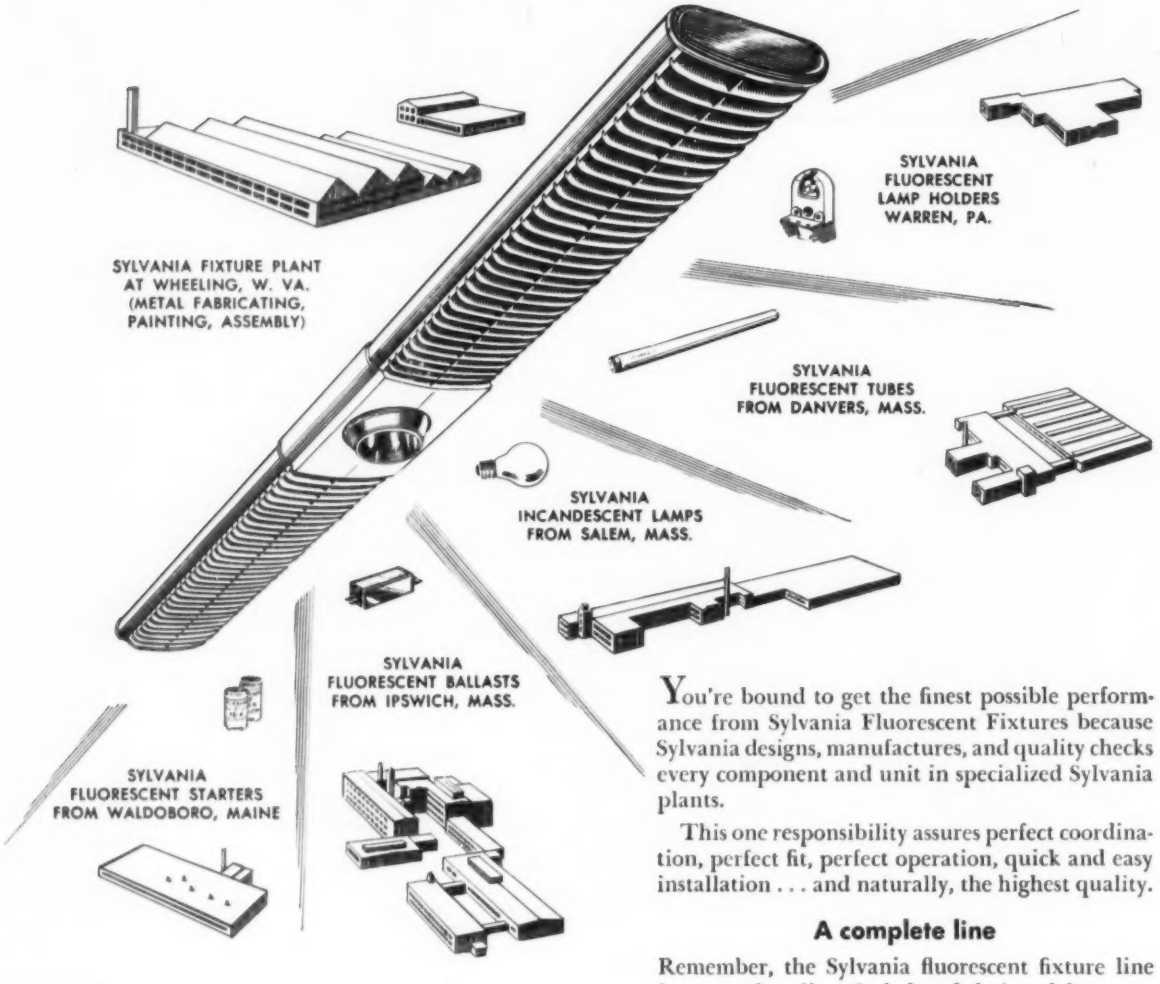
☐ Please give me more information on U·S·S AMPYROL.
☐ Have representative call.

Name .....
Title .....
Company .....
Address .....
City ..... State .....

UNITED STATES STEEL

ONE MANUFACTURER... ONE RESPONSIBILITY

Guarantee "Fluorescent at its Finest"


SYLVANIA FIXTURE PLANT AT WHEELING, W. VA. (METAL FABRICATING, PAINTING, ASSEMBLY)
SYLVANIA FLUORESCENT LAMP HOLDERS WARREN, PA.
SYLVANIA FLUORESCENT TUBES FROM DANVERS, MASS.
SYLVANIA INCANDESCENT LAMPS FROM SALEM, MASS.
SYLVANIA FLUORESCENT BALLASTS FROM IPSWICH, MASS.
SYLVANIA FLUORESCENT STARTERS FROM WALDOBORO, MAINE

You're bound to get the finest possible performance from Sylvania Fluorescent Fixtures because Sylvania designs, manufactures, and quality checks every component and unit in specialized Sylvania plants.

This one responsibility assures perfect coordination, perfect fit, perfect operation, quick and easy installation . . . and naturally, the highest quality.

A complete line

Remember, the Sylvania fluorescent fixture line is a complete line. Styled and designed for every need . . . for offices, factories, stores, schools, and homes.

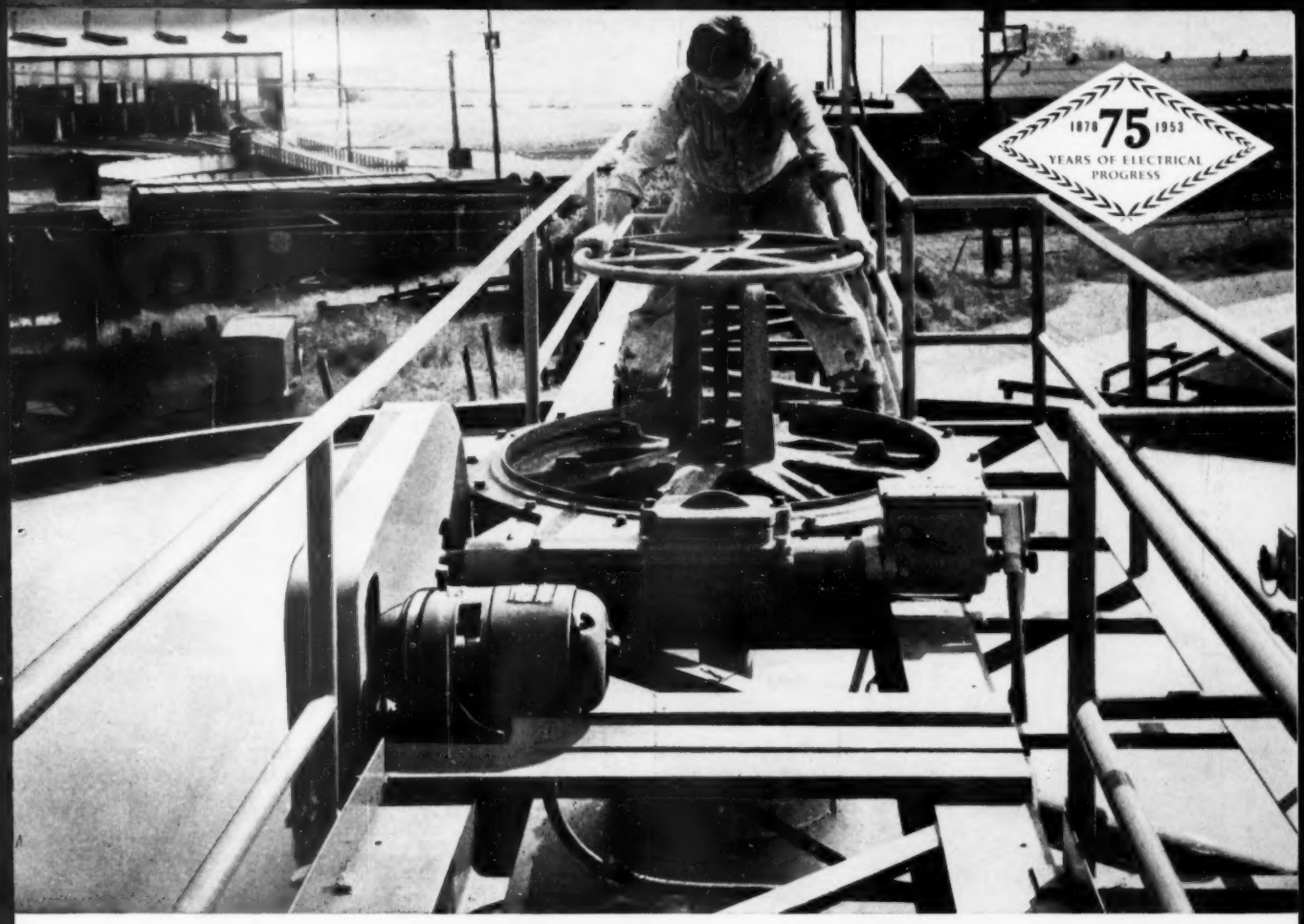
Backed by the Broadest Guarantee in the Lighting Industry

Sylvania Fluorescent Fixtures are covered by a complete written guarantee which includes every unit and part. Tubes, starters, ballasts and all other components are guaranteed for one entire year from date of installation.

SYLVANIA

Sylvania Electric Products Inc., 1740 B'way, N. Y. 19, N. Y.

FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; PHOTOLAMPS; TELEVISION SETS



THIS G-E GEAR-MOTOR WAS PICKED TO RUN A SLUDGE ACCUMULATOR 24 HOURS A DAY AND 7 DAYS A WEEK BECAUSE . . .

New G-E Gear-motor Reduces "Down-time"

Easy stator removal, use of Tri-Clad* motors, cuts maintenance costs and time more than 50%.

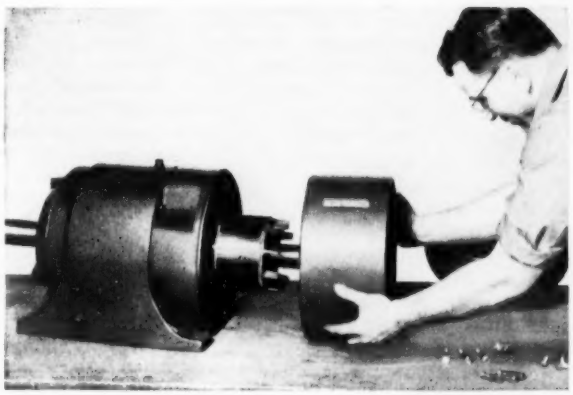
G-E Gear-motors are single units—compact and efficient—the most economical method of gear reduction for low-speed drives. This year, they have been redesigned to offer you additional operating economy.

EASY STATOR REMOVAL is now possible without disturbing the gear-train in any way. Also, any standard G-E motor—with or without feet—may be used as a stator replacement. These advantages mean a reduction of non-productive "down-time"—and substantial cost savings!

TRI-CLAD MOTORS are now an integral part of every G-E Gear-motor. These are the same motors which have gained such a wide acceptance throughout industry—the motors which assure you of extra reliability—triple protection against physical damage, electrical breakdown, and operating wear and tear.

A new stocking plan keeps most popular ratings available on a 1-week basis. You can order your gear-motor from your nearest G-E Apparatus Sales Office or your Authorized G-E Agent or Distributor. General Electric Company, Schenectady 5, N. Y. 735-10

Registered Trade-mark of General Electric Company



Rabbet fit between stator and gear-motor frame assures positive realignment. Note that stator removal is simply a matter of removing a few bolts—can be done without disturbing gear-train.

GENERAL ELECTRIC

48 Superduty ¼" Models—8 speeds, from 500 to 5000 R.P.M. Choice of pistol or saw-type grip.

3 Superduty ⅜" Models, 400 to 1000 R.P.M.

3 Superduty ½" Models, 500 to 600 R.P.M.

One or more of these PET Superduty Models will EXACTLY meet any drill user's needs!

PET POWER TOOLS

Why the complete PET Superduty line offers you the right drill for *YOUR* job!

Any maintenance or production man will agree that the right drill for the right job means three things: better work, greater efficiency and longer drill life. So why compromise on a drill that's "almost" right?

PET Superduty Drills are available in 54 separate and distinct models . . . the various speeds and rated power have been carefully selected on the basis of what industrial users have needed and asked for. Result? You get a wide selection . . . and end up getting the drill that's *exactly right for your work.*

And, a wide selection isn't the only thing you'll like about the PET Superduty line. Just plug in one of these drills: feel the vibration-free power as it flows from a dynamically-balanced armature through precision-cut gears. Then you will know you've found a drill that will stand up in rugged service day in and day out—and still come back for more!

For complete details on the best in electric drills—sold at prices that will come as a pleasant surprise—find out the name of your nearest PET Distributor. Write today, to Portable Electric Tools, Inc., Dept. EC-23, 320 West 83rd St., Chicago 20, Ill.

Be sure to ask for this free catalog!

Compare these quality drills for yourself . . . model by model, feature by feature. This illustrated catalog gives you the complete story. Free copy by return mail.

The features you want are the features you get—in PET Superduty Drills

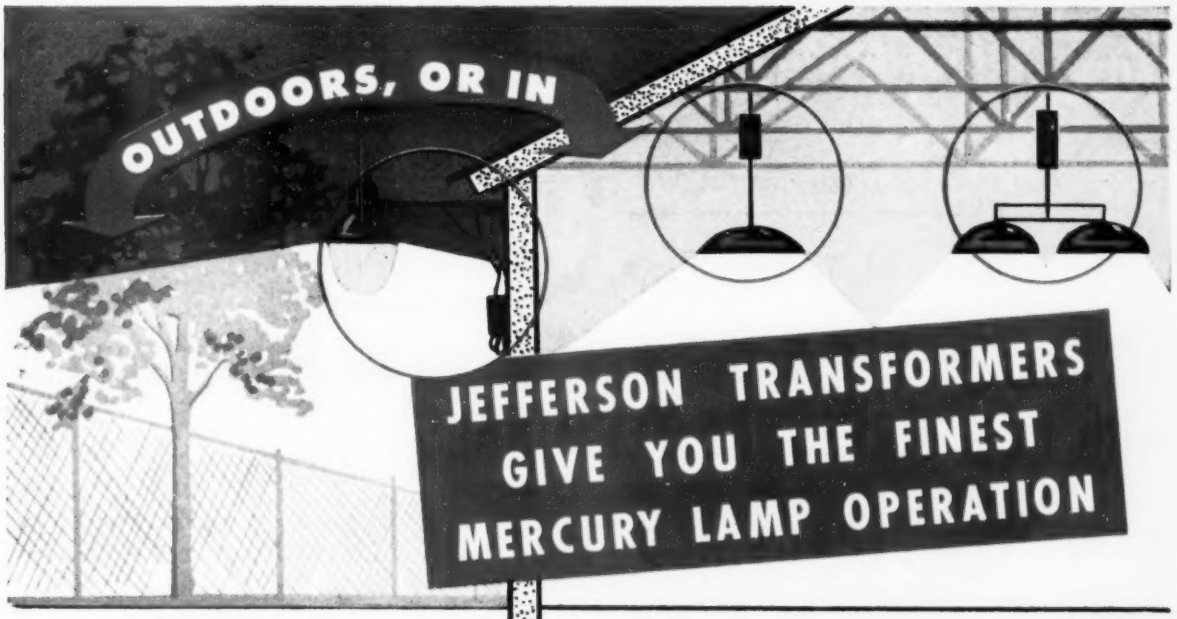
- **Reserve Power; for the extra-tough job**
- **Heavy-Duty ball and needle bearings**
- **Precision-Cut, Heat-Treated Gears; for smooth, quiet power flow**
- **Dynamically Balanced Armatures; for freedom from vibration**
- **Forced Ventilation; for cool running**
- **Aluminum Alloy Die Castings; for light weight, easy handling**
- **Compact Design; makes hard-to-reach drilling jobs easier and faster**
- **Meet U. S. Government and Military Specifications**

PET POWER TOOLS

PORTABLE ELECTRIC TOOLS, INC.

320 West 83rd Street, Chicago 20, Illinois

In Canada: Portable Electric Tools, Ltd., Toronto, Ontario



JEFFERSON TRANSFORMERS GIVE YOU THE FINEST MERCURY LAMP OPERATION

FOR OUTDOOR SERVICE

The finest transformers for outdoor operation of all H-1 400 watt mercury lamps. From core and coil to seamless hot-dipped galvanized case, every modern design and construction feature has been built in for longest transformer life and maximum lamp performance.

Every Jefferson Transformer is engineered to the highest quality standards. All are in deep drawn *weatherproof* cases for years of positive protection against the elements. Each has *all* the extra value features found *only* in Jefferson Transformers.

Streamlined hot-dipped galvanized case sheds water like a duck. No seams, no cracks, no place for moisture to seep in. Welded bracket has keyhole slot for easy mounting. Dura-Gray harmonizing finish for modern, attractive installations.

Large handhole gives easy access to color-coded tagged leads. Correct installation is quick, positive.

Patented Jefferson Adaptor converts wall and post mounting transformers to pole top units in minutes. Transformer stocks can be cut drastically as one type transformer can be mounted wherever needed—wall, post, or pole-top with an adaptor.

Universal Adaptor fits any pole top from 2-1/2" to 4" O.D. — fills every need. It's inexpensive, easy to mount. Provides a solid, weatherproof base for the transformer. Comes fully equipped with outlet fittings.

FOR INDOOR SERVICE

Jefferson two-lamp transformers cut installation costs by reducing wiring up to 50%. High power factor design delivers maximum lumens per watt. Failure of one lamp does not affect the operation or brilliancy of the remaining lamp. Stroboscopic effect is minimized since the two lamps operate out of phase with each other.

Mercury and incandescent lamp wiring facilities are provided at both ends in ample wiring compartments. Leads are color-coded and tagged. One-half and ¾" knockouts are provided in both sides of each wiring compartment and in both end plates for trouble free wiring. Condenser is mounted in a separate compartment for efficient cooling and maximum life.

TWO-LAMP TRANSFORMER

Jefferson Single Lamp Transformers give you every vital feature for top-notch lamp operation and economy. Press-fit riveted core, double varnished core and coil assembly, three primary taps (not just two), easy mounting brackets, and incandescent as well as mercury lamp leads out of both ends are a few of the outstanding Jefferson features. You get all these extra values in Jefferson Transformers, yet they cost no more than ordinary transformers.

Specify Jefferson for the best operation of every mecury lamp installation. New 16-page illustrated Bulletin 521-5 gives complete data on H-1 400 watt models as well as the new Jefferson Transformers for H-12 and H-15 1000 watt mercury lamps.

JEFFERSON ELECTRIC COMPANY
BELLWOOD, ILLINOIS

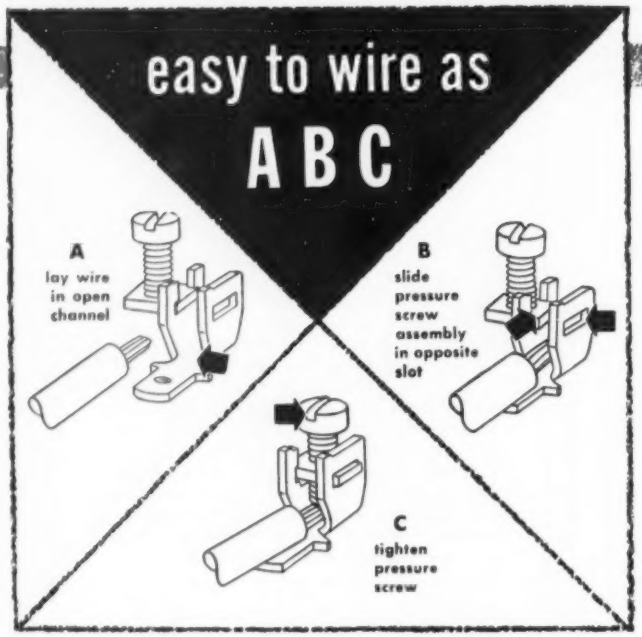
SINGLE LAMP TRANSFORMER

Jefferson Transformers

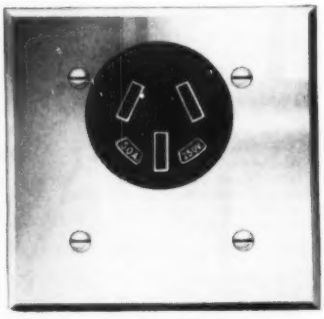
For Easier, Faster, Safer Wiring

THE ANSWER IS
BRYANT
WIRING DEVICES

50 Ampere, 250 Volt Range and Power Receptacles with NEW PRESSURE TERMINALS*



No. 3826—Surface Mounting



No. 3846—Flush Mounting

There are no loose parts to mislay . . . pressure screw assembly permanently attached to the wiring channel. Rounded channel confines wire strands. Assembly terminals are cadmium-plated for either copper or aluminum wire.

Other Features – No. 3826 has easy-to-remove knockouts for ¾ or 1 inch cable . . . a rugged plastic cover . . . and built-in cable clamp.

– No. 3846 has satin-finish stainless steel flush plate (.060" brass plate available on order). Plates with grounding contacts also available. Welded mounting bracket assures proper alignment of mounting holes.

BRYANT
SUPERIOR WIRING DEVICES

J-72385

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut
Chicago • Los Angeles
Listed by Underwriters' Laboratories, Inc.

*Pat. Pending

7,000 fasteners set in concrete in 3,500 minutes

Saved $15,000 on 50,000 fastenings into steel

Fastener cost reduced from $2.53 to 24 cents

Cut fastening time from 9 minutes to 58 seconds

Lowered fastening cost 87%; reduced time 90%

Split-second fastening into steel or concrete with super-speed *Ramset Jobmaster*

FASTENING SYSTEM

Just as thousands of users have been saving for six years, you can slash cost and time of fastening into steel or concrete with RAMSET SYSTEM, pioneer in powder-actuated fastening.

Let us prove, on your own work, how the ten big features of the new RAMSET JOBMASTER add up to new speed, new economy, new ease, new utility. See the lightning-fast action—one-hand operation—accuracy of positioning—straight, firm penetration which only the JOBMASTER gives you.

Ask your dealer to do a sample job for you, and prove the dollars-and-cents value of doing every fastening job with RAMSET.

Always use Tru-Set Fasteners

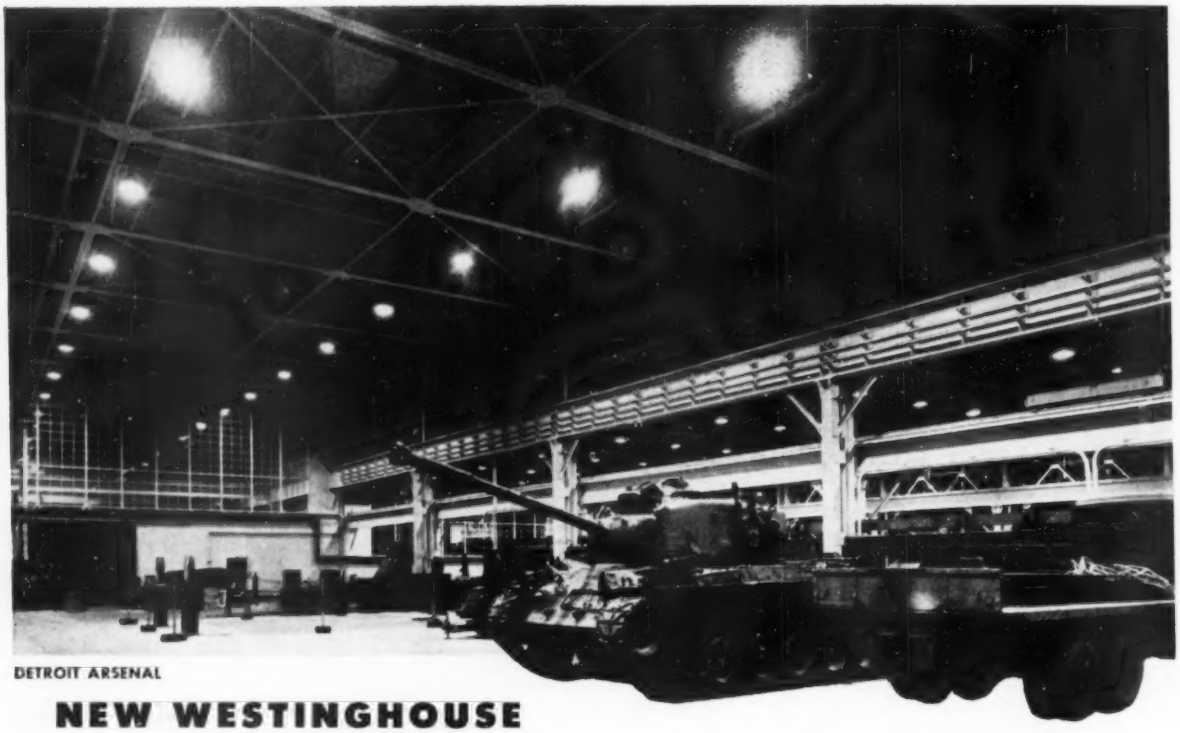
Exclusive Red-Tip Pilot guides them straight to the work, with highest efficiency in performance. Four types in 56 sizes for split-second fastening into steel or concrete.

*Names of these RAMSET users and others in your locality available on request.

Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.

12117 BEREA ROAD • CLEVELAND 11, OHIO



DETROIT ARSENAL

NEW WESTINGHOUSE 1000 WATT FLUORESCENT-MERCURY LAMP —*The Cheapest Source of Mass White Light!*

Brighter, higher quality light at lowest cost—that's what engineers of the Chrysler Corporation sought for this newly erected Tank Assembly Wing of the Detroit Arsenal.

As in so many other industrial installations, the new Westinghouse 400 Watt J-H1 and the 1000 Watt C-H12 Fluorescent-Mercury Lamps met the demand for longer burning life—more economical performance due to lamps of higher efficiency—and reduced maintenance costs.

A pleasant, golden-white working light is provided by the Fluorescent-Mercury Lamp, which is both flattering to personnel and suitable for most types of lighting service. The rated lives of 4,000 to 6,000 hours respectively of the 1000 Watt C-H12 and 400 Watt J-H1 assure minimum maintenance. And the J-H1 and C-H12 may be operated from ballasts now used for the 400 Watt and 1000 Watt Mercury Lamps.

These Fluorescent-Mercury Lamps are recommended for large-scale outdoor as well as indoor applications. For 480 volt lighting circuits and for street lighting where 1000 Watt lamps are to be used, the new B-H15 is recommended.

For detailed information on how the world's least expensive source of mass white light can be employed in your present or planned lighting installations, write to Lamp Division, Westinghouse Electric Corporation, Bloomfield, New Jersey.

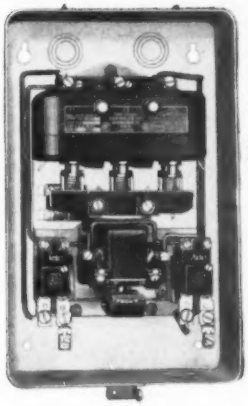
Golden-White Light Shows Real Colors. Golden-white light of Fluorescent-Mercury Lamps eliminates the need for incandescent color correction, even in color-coded assembling operations. This high-quality white light improves worker morale, aids production in industrial installations of every kind. And the long 4,000-to-6,000-hour burning life of the Fluorescent-Mercury Lamps reduces maintenance costs.

YOU CAN BE SURE...IF IT'S

Westinghouse

CLARK TYPE "CY" SUPERIORITY AT ALL POINTS OF THE COMPASS

MAGNETIC ARC INTERRUPTORS WITH STEEL ARC SHELL
ONE PIECE UPPER ARC SHELL
FINGER CLIPS FOR EASY INSPECTION
NO SPRINGS ON VERTICAL LIFT MAGNET
DOUBLE BREAK SILVER CONTROL CIRCUIT CONTACTS
CAPTIVE SCREWS IN CONTACT ARM
ALL PARTS FRONT REMOVABLE
ENTIRELY NEW ARC QUENCHING PRINCIPLE
MELTING ALLOY TYPE OVERLOAD RELAYS
PRESSURE TYPE TERMINALS
NON-CARBONIZING ARC SHIELDS

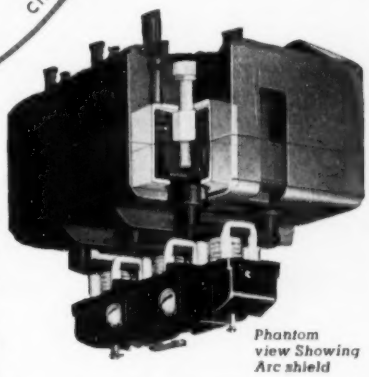


Size 2 Non-Reversing Type "CY" AC Motor Starter

Nationwide customer acceptance and satisfactory use of CLARK TYPE "CY" STARTERS in all types of industries is the best proof of their superiority.

The new arc quenching principle, in which the arc is constantly forced to rotate from a hot spot to a relatively cool spot, has proved its efficiency in thousands of installations.

The constant moving of the arc effectually prevents pitting of contacts—thus resulting in longer contact life.



Phantom view Showing Arc shield

Available in standard across-the-line, with safety switch or circuit breaker, reversing, and multi-speed types, and in all standard NEMA air break type of cabinets. There's a Type "CY" starter to meet every possible operating application and condition.

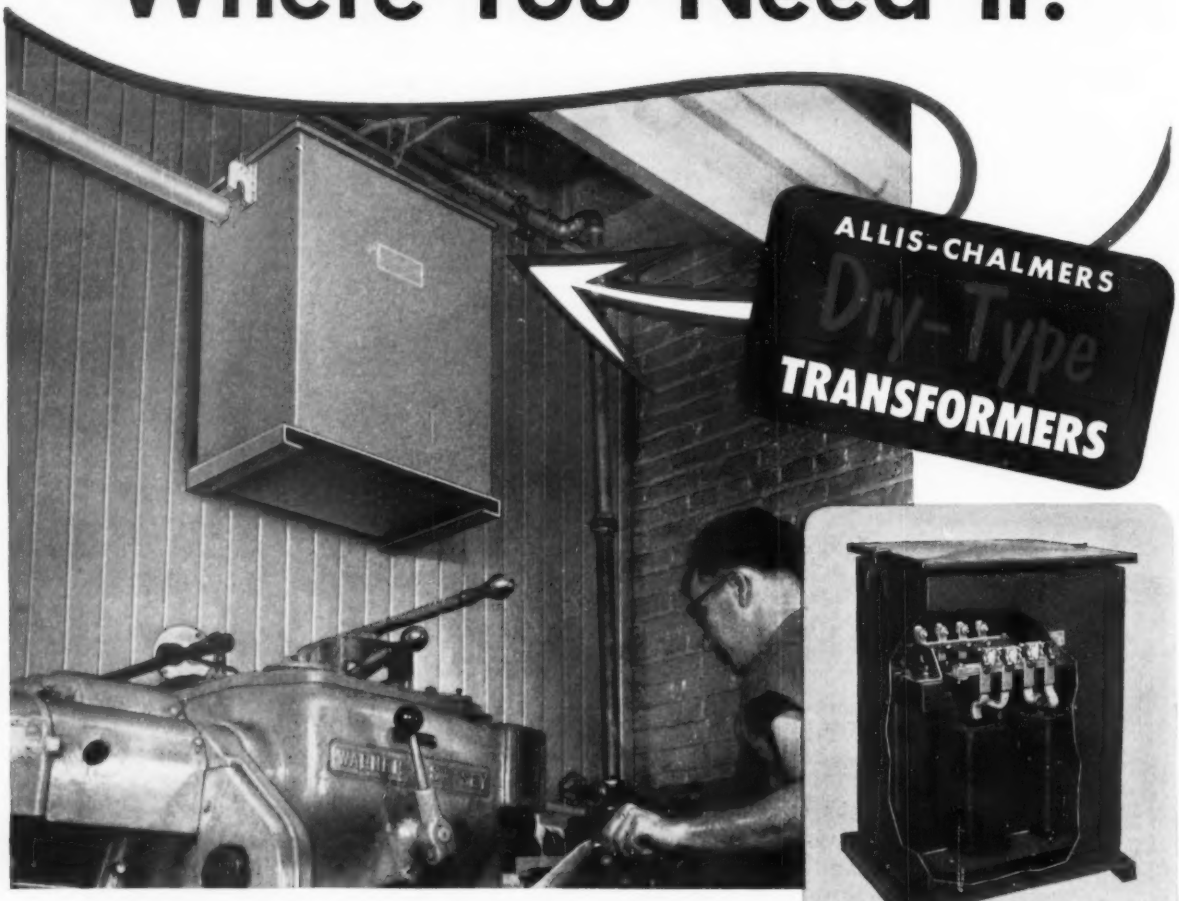
You owe it to your customers, in avoiding down time, costly maintenance, and keeping up high production, to install *Clark Type "CY" Starters.*

Why don't you try CLARK TYPE "CY"?

THE CLARK CONTROLLER CO.

ENGINEERED ELECTRICAL CONTROL • 1146 EAST 152ND STREET, CLEVELAND 10, OHIO

PUT POWER Where You Need It!



HERE'S THE WAY to assure rated voltage for motors and other equipment. Install Allis-Chalmers dry-type transformers close to the load to provide full voltage for efficient motor operation, flicker-free lights, and full heating of thermal equipment.

You can mount them anywhere, on posts, beams or walls, in a small amount of space, or right on the machine itself. You don't need vaults or expensive enclosures.

Installation is easy because junction boxes are eliminated. Knockouts are provided for connecting conduits directly to the transformer case. System cables are connected to the transformer terminals in compartments.

Maintenance is easy, too. You install Allis-Chalmers transformers and forget them except for periodic inspections. There are no insulating liquids to maintain; no gauges or gaskets to fuss with.

Get more information from your Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wis.

A-3980

IT'S ENDURANCE BUILT

Core and coil assembly is impregnated to guard against moisture and dirt. All-welded, modern looking case protects the internal assembly. Case is Spra-Bonderized to protect it against corrosion. Three coats of baked-on alkyd resinous paint furnish additional protection.

Ratings 167 kva and smaller (single phase); 300 kva and smaller (three phase); 600 volts and below.

ALLIS-CHALMERS

Washington Report

Washington planning is emerging slowly from its status quo basis maintained since last November. Lesser officials have been waiting for new top policy decisions from President Eisenhower and his new Administration leaders. These decisions are firming up gradually. But this all takes time, and many programs will be slow in taking final shape.

Eisenhower's tax policy, already announced, is to first balance the budget, then cut taxes. But Truman's 1953 fiscal budget (July 1, 1953 to June 30, 1954) calls for $78.6 billion spending, $68.7 billion receipts, with deficit of $9.9 billion. Thus its apparent a balanced budget won't come easy, even with sizeable cuts in federal spending. Revenue from all existing taxes is needed, so don't look for relief in 1953. If the unpopular excess profits tax is permitted to expire June 30, according to schedule, its $2.5 billion annual revenue will probably be raised by suitable rise in corporation income tax now favored by Congress for more equitable distribution of tax burden.

Emergency mobilization controls set up by Truman are generally being dropped. Price-wage ceilings will be first to go. Most DPA controls on production through NPA's CMP control of materials will be revoked. But there is sentiment in Congress to maintain a CMP-type of materials control framework as a safety measure in case of unexpected materials shortages or an expansion of military activities, or all-out war.

A super-planning mobilization agency composed of top defense and civilian agency officials will be set up by Eisenhower in a few months. Its function will be to correlate overall defense plans with the civilian economy, make major determinations with respect to the size military force the nation can maintain, to the division between military and civilian needs, etc. It will be an expansion of the concept of the old National Security Resources Board established soon after WWII, which failed to develop any worthwhile plans as was forcibly demonstrated at the inception of the Korean crisis. Industry studies made by NPA in recent months based on statistics gathered by that agency will provide valuable background material for the new agency.

Steel supply is steadily improving, and should reach a balance with demand during the 2nd quarter. U.S. steel-making capacity rose 8.9 million tons in 1952, raised total annual capacity to 117.5 million tons—an increase of 17 million tons annually since Korea. Current production is approximately 2.25 million tons weekly.

More new refined copper was delivered to American industry last year than in any year since 1945. But U.S. copper consumers need a high level of imports. Thus, the first legislative measure to be passed by either branch of the new 83rd Congress was a bill which continued suspension of the 2¢ per pound import duty on copper. Prompt Senate passage is expected before existing suspension ends February 15th. Total current demand for refined copper is about 174,000 pounds monthly, domestic supply about 140,000 pounds.

Aluminum capacity is adequate for current needs, but supply is temporarily short due to slowdown in production in Pacific Northwest, due to water and power shortage there.

The power switchgear industry's order backlog now represents over a year's production, NPA reported to the Power Switchgear and Circuit Breaker IAC on January 16, which committee members said was caused by a current increase in orders due to heavier AEC purchases. They predict the backlog will drop appreciably during 1953.

For More Than Seventy Years

CRESCENT WIRES & CABLES

Have Played A Leading Role In The Growth of the Electrical Industry

OVER 70 YEARS EXPERIENCE

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

FEBRUARY . . . . at a Glance

JIC Standards

To some of our readers the term "JIC Electrical Standards" may have a familiar ring. Particularly those in the large mass production industries. Others may never have heard it. All should know that such a document, although unofficial, exists. Its impact, on wiring machine tools to increase safety, and reduce maintenance cost and production downtime, is tremendous. You may encounter it in your work.

Briefly, the Standard is a set of regulations covering machine tool wiring developed by machinery users in cooperation with manufacturers. To see how they have made a maintenance man's dream come true, read R. W. Kowitz's article "More Safety and Less Maintenance" on page 82.

At a Glance

At the NAHB show in Chicago last month several manufacturers displayed central summer air conditioning equipment for small homes. In spite of the big tickets, interest ran high among the builders. They expect central cooling to become an important sales feature in new homes priced in the upper and middle brackets. Wiring designers please note, the name plates on the compressors are running 2 and 3 hp single phase with one or two fractionals for air handling. Circuits will be 10's or 8's, 220v, with 40 or 50 amp time delay fuses or circuit breakers at the panel. About 5 kw in service, panel and feeder capacity should be figured at 100 percent diversity for each 1500 square feet. Where no equipment is installed, but provisions must be made for future central cooling a good plan is a No. 6 feeder to a 6 circuit load center at the proposed location including a 50 amp 220 volt compressor circuit and 4 20 amp 110 volt circuits for heating plant, blowers and auxiliaries, electric air cleaner and a spare. Wiring provision for central cooling can no longer be put off to some vague future. It is on the boards for Spring building this year.

Heavy Appliances

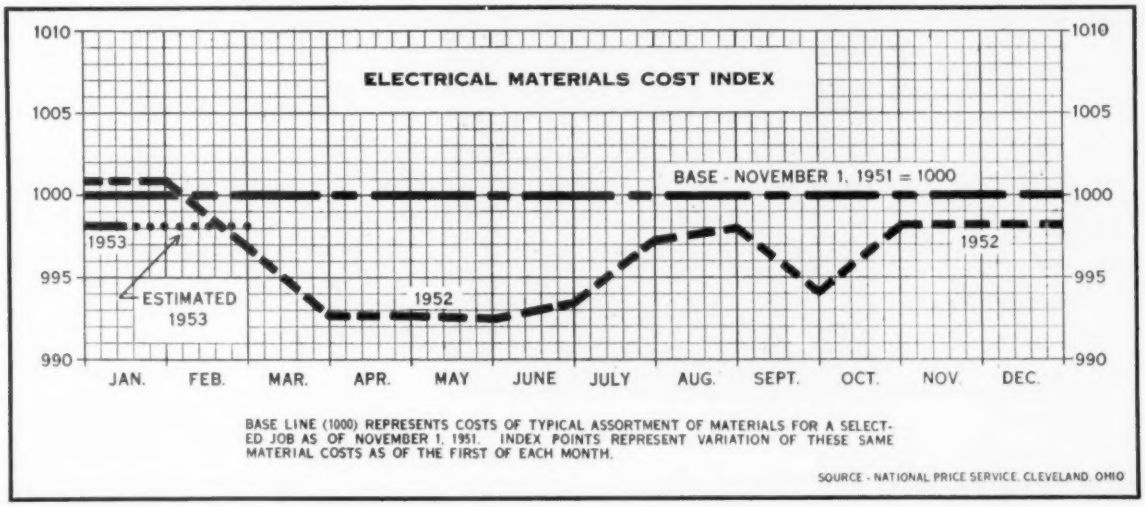
Reports on new major appliances are now appearing in our New Product department (page 119). These reports will include data on built-in appliances, major appliances operating at or near full circuit capacity or requiring special circuits and such other appliances as require special wiring consideration. We shall try to edit these reports not only for electrical contractors who merchandise appliances, but also for those who must keep informed on appliance developments to adequately design and service residential wiring systems.

Wiring Symbols

What with load center substations, bus duct distribution, fluorescent lighting and relay switching the current standard electrical symbols for wiring plans are rapidly becoming obsolete. A technical committee is gathering data for recommending additions and modifications to present standards. Our editorial department will welcome your suggestions.

Armor Cable Feeders

When the Canton Forge Division of Ford Motor Company outgrew the capacity of its electrical distribution system, rewiring was in order. Collaboration of Ford Engineers, Hilscher-Clarke Electric Company (contractor) and General Electric Company specialists produced a 20,000-kva service with 13.8-kv feeder system to load-center unit substations. To keep installation time and plant production "down time" to a minimum, the engineers chose interlocked armor cables on open racks as the high voltage feeders. The electrical contractor handled the complete job, subletting construction of the main switchgear building and cable suspension bridges. Hilscher-Clarke engineer D. L. Westhoeffer tells how these feeders were installed in his article "Modernized Distribution System" on page 76.



BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.

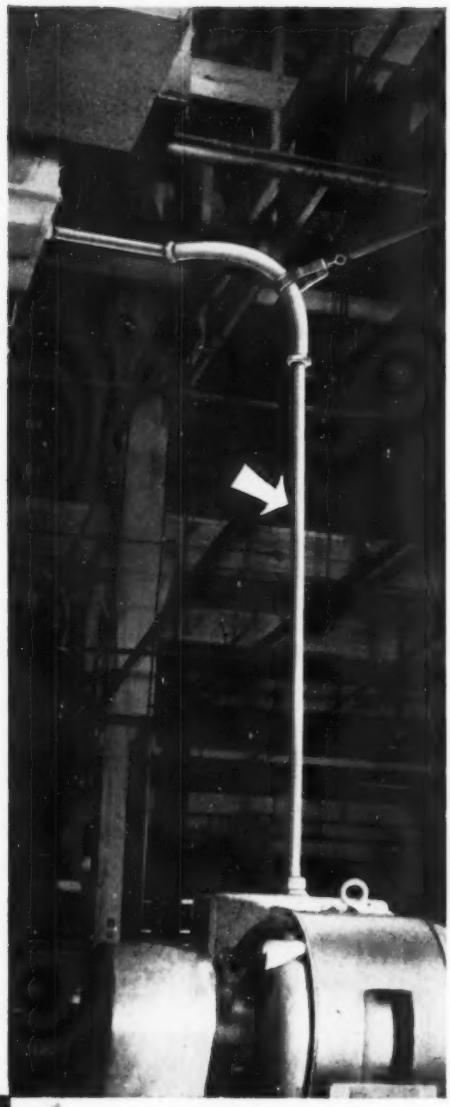
SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

How High Standard Mfg. cuts costs by using POWERDUCT from busduct to machine

"Powerduct Cable means a big saving for us," says Frederick Lynn, chief electrician at The High Standard Mfg. Corp., Hamden, Conn., makers of Hi-Standard firearms, internationally famous for their accuracy and painstaking craftsmanship.

"You'd be surprised that a very big item is being able to use Powerduct over and over again as production increases and model changes are made. Twelve feet, fifteen feet, it doesn't make any difference. I'm able to use it any place. Powerduct is never wasted. That's why it's less expensive.

"Because busduct with Powerduct means complete flexibility, we increase the use and mobility of the machine. Our crew saves many man-hours by being able to plug in Powerduct instead of wiring a whole rigid conduit system."



"For heavy equipment we plug the cutout in the busway and run the Powerduct almost directly to the machine. It's not likely this machine will be moved, so the usual loop is not necessary."

"Here's the installation for lighter equipment. By varying the size of the loop I can move the machine."

Powerduct complies with Section 3646 to the 1951 National Electrical Code.

Powerduct has full Underwriters' approval, costs less than any other approved type of cable. For further details on Powerduct, contact your nearest Anaconda Distributor or Anaconda Sales Office—or write to Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

22176

the right cable for the job ANACONDA® wire and cable

ELECTRICAL CONSTRUCTION AND MAINTENANCE

52nd Year—FEBRUARY • 1953

Group Replacement

LIGHTING MAINTENANCE is big business. Besides plant maintenance crews devoted almost exclusively to keeping lighting systems in order, a rapidly growing number of electrical contractors offer a contract maintenance service for all kinds of industrial or commercial lighting systems. Advancing lighting technology has multiplied the problems of maintenance. It has also stimulated wide interest in maintenance methods of which the most important development in recent years is the group lamp replacement plan.

GROUP REPLACEMENT provides complete area relamping on a predetermined schedule. The replacement schedule is set up for less than normal lamp life. By discarding a small portion of the relatively inefficient end life of the lamps individual burnout replacement is held to a minimum. With scheduled cleaning and group lamp replacement the engineer can predict accurately the performance of the lighting system and hold whatever practical value of average performance he chooses.

SINCE LABOR is a large part of lighting maintenance, the cost advantages of group replacement are in discarding a few cents worth of probable lamp life for substantial savings in time. The principles are applicable to small installation or large and once recognized will practically eliminate the widely prevalent practice of running fluorescent lamps to blinking or burnout.

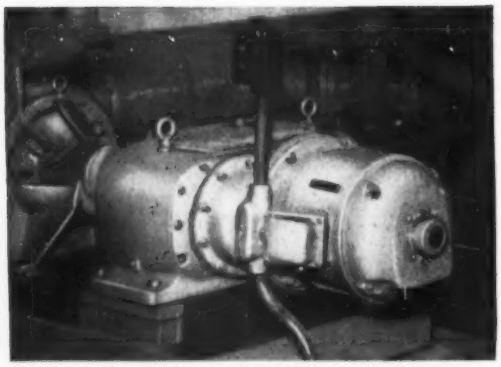
MAINTENANCE PLANNING ought to be an essential part of the initial lighting design. Unfortunately, emphasis on maintenance has been lacking in lighting sales activity. Too often the user, unless he has a skilled maintenance organization, finds himself, a year or so after the installation is completed, with a major problem. He then has to learn the hard way that lighting maintenance is a technical operation bearing directly upon the satisfactory and efficient performance of his lighting system.

MODERN LAMPS AND LIGHTING EQUIPMENT and rapidly improving illumination technology are giving us some fine examples of modern lighting practice. The maintenance of the lighting values so skillfully created should not be left to haphazard housekeeping. The group lamp replacement plan is an excellent device to keep control of the job and insure the customer against costly deterioration in performance.

Wm. T. Stuart

POWER — WHEN AND WHERE IT'S NEEDED. Smooth, steady power for any production line begins when you install Graybar-distributed G-E motors and controls. AC or DC . . . general- or special-purpose, G-E Tri-Clad motors offer your customers extra protection against physical damage, electrical breakdown, and operating wear. Given ordinary care, you can count on G-E motors for dependable service under even the toughest operating conditions.

This team pays off in performance



MATCHING G-E MOTOR CONTROLS give full protection against injurious overloads . . . provide maximum flexibility of motor operation. All live parts are completely enclosed, yet cases are easily accessible and have ample conduit knock-outs and terminals for easy installation.

General Electric Tri-Clad motors and matching G-E controls make a hard-to-beat production team. Your customers get reliable, uninterrupted performance shift-after-shift—a practical defense against downtime due to motor failure.

Graybar distributes the complete line of G-E motors and controls. Your local Graybar Representative can help you select the proper equipment for any machine-drive requirement . . . help you analyze special service conditions that demand totally-enclosed motors, variable speed motors, gear motors, or reversible motors.

Check with him, too, for details on the G-E Motor Exchange Plan. Covering popular fractional and integral ratings, this plan lets you make emergency replacements of inoperable motors through a simple over-the-counter transaction.

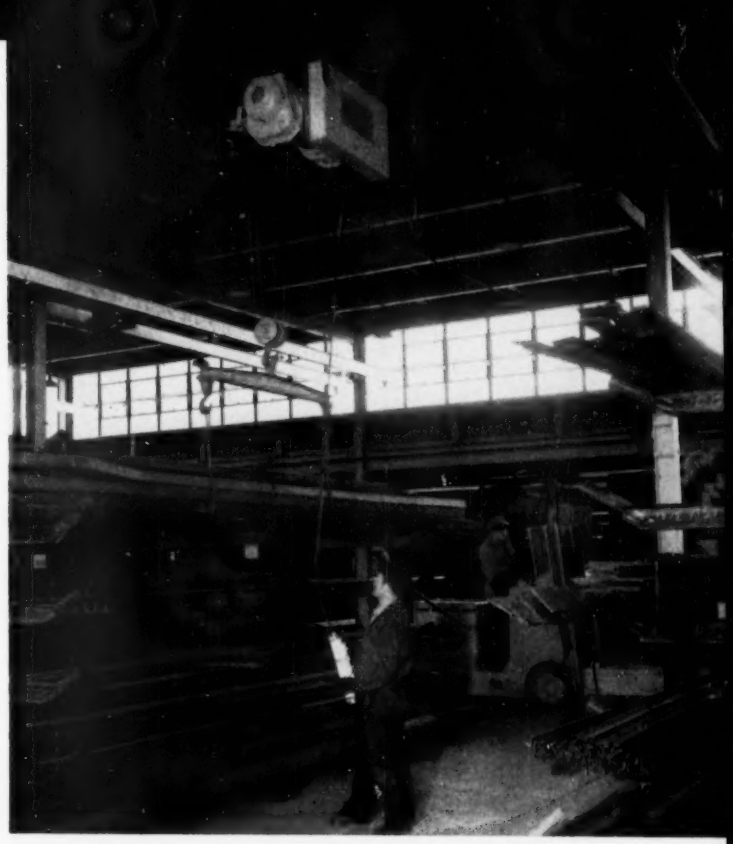
Graybar can furnish you and your customer with practical advice on the installation and usage of over 100,000 different electrical items. For help in speeding lighting, communication, ventilation and wiring projects of all types, call our nearest office. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, New York 17, N. Y.* 246-12

Call Graybar first for... GraybaR Everything Electrical

IN OVER 100 PRINCIPAL CITIES

Modern electrical distribution and control methods, scores of practical motor applications and variety of materials-handling techniques are to be found in Salt Lake City's huge new merchandising center operated by ZCMI* wired by the Wasatch Electric Company.

By Laurence E. Baty



BRIDGE CRANES span four separate bays used for steel storage, yet only two remote-control 3-ton hoists are required to serve the combined areas. This is possible due to existence of fixed cross-over sections connecting adjacent crane rails. Extensive use is also made of battery trucks, electric tractors and motor-operated draglines.

Wiring A Wholesale Center

FIVE miles from traffic-congested downtown Salt Lake City is America's first single-stop wholesale center where, in one convenient location, retail merchants can do *all* their mass buying—of hardware items, appliances, furniture, dry goods, drugs and floor coverings. Owned and operated by ZCMI*, the center is located in a 10-acre converted defense plant, completely remodeled since the war to incorporate up-to-the-minute facilities for efficient storage, display, sale and delivery of goods.

A flexible distribution system provides electrical service at 480-, 208- and 120-volts. Bus-duct and load-centers are used wherever applicable. Multi-breakers, limit switches, automatic trips, relays and remote controls safeguard both merchandise and operators. Materials-handling is expedited by crane, conveyor, monorail and industrial truck. Year-round air conditioning is provided by combination heating and cooling "Weather Makers." And vertical transportation is by elevators ranging up to 10 tons capacity.

Receipt and delivery of goods, outside the plant, is by rail (with receiving docks capable of handling 14 freight cars simultaneously), truck (also with 14 loading positions) or private vehicles. Inside the plant merchandise is handled with minimum effort and maximum speed, while movement of personnel in this huge center is speeded by scooters, bicycles, even roller skates. All of these fast transportation means, coupled with an interplant pneumatic tube system for prompt dispatch of orders, result in top-flight efficiency and exceptional service for customers. Large orders formerly requiring days to fill are now handled in a matter of a few hours—a fact meriting deserved recognition and praise.

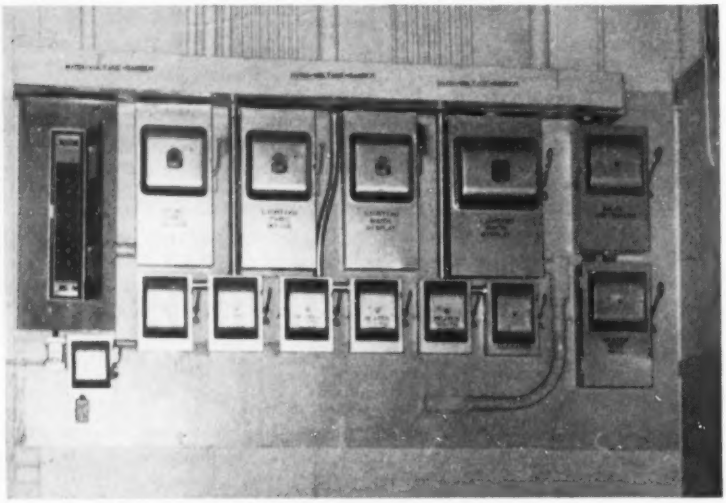
Power from Utah Power and Light's 44-kv system cascades through a primary substation to 7200-volt distribution feeders, then further reduced to 480-volts through a 100-kva delta-delta transformer and to 120/208-volts via a 300-kva delta-wye unit. Maximum combined 15-minute demand is approximately 380-kw.

Post War Conversion

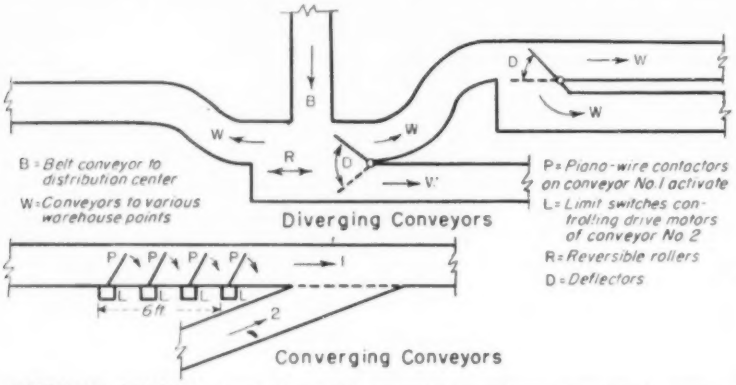
Since present use of the center is a far cry from its initial design as an ammunition manufacturing plant, the distribution system has been revamped drastically. Busducts were shifted or disassembled to provide unobstructed areas for office, display and storage space. Branch circuits were run to new sections in some cases; in other

*** Zion's Cooperative Mercantile Institution was organized in 1868 by Brigham Young and a group of Utah's leading merchants to combat exorbitant distribution profits. This present Center brings together services formerly located in a score of separate, widely scattered buildings.**

MOTORIZED DRAG-LINES move 1-ton dolly trucks throughout the shipping department. Mechanical transfer devices, spur-chain motors, low-voltage controls and manually-set destination flags automatically shunt dollies to their intended loading platforms.



DISTRIBUTION CENTER provides central location for all main 440-, 120- and 208-volt controls. Enclosures are legibly stencilled to preclude operational errors.



INCOMING STOCK is diverted to widely-separated warehouse locations by means of belt conveyors, reversible rollers and electrically-operated deflectors. Outgoing orders are assembled on converging conveyors; package pile-ups prevented through the use of spring-steel trips, limit switches and relays.

instances reconnected to different panels to facilitate control or to balance the loading of feeders. Lighting was altered progressively to include decorative treatments in the lobby and waiting room, accent highlights for displays, attractive commercial fixtures in offices, high-level functional illumination for inspection purposes and conventional industrial lighting for stockrooms, storage space and shipping docks.

In all general office and display areas, these necessary electrical revisions were made by the Wasatch Electric Company of Salt Lake City. The balance of the plant was electrically revamped by ZCMI maintenance personnel.

Since conversion completion, this maintenance crew has also established a practical trouble-preventive program, consisting of regularly scheduled inspections of equipment, periodic cleaning and maintenance of lighting fixtures, motors, switchgear, transformers, controls and materials-handling apparatus.

Materials-Handling Methods

In connection with maintenance of electric tractors and fork-lift trucks, batteries are kept charged by selenium rectifiers (for 6-cell 12-volt 50-90 amps dc units) and m-g sets (for 12-cell 250-275 amp-hour batteries).

Another important maintenance assignment concerns the extensive conveyor systems, since reversible motors, pushbutton controls, automatic package deflectors and limit switches must be constantly reliable. Motor controls are located at numerous points along conveyor lines so that, regardless of an attendant's temporary location, he can take quick remedial steps to prevent congestion, pile-ups or damage to merchandise on the belt lines.

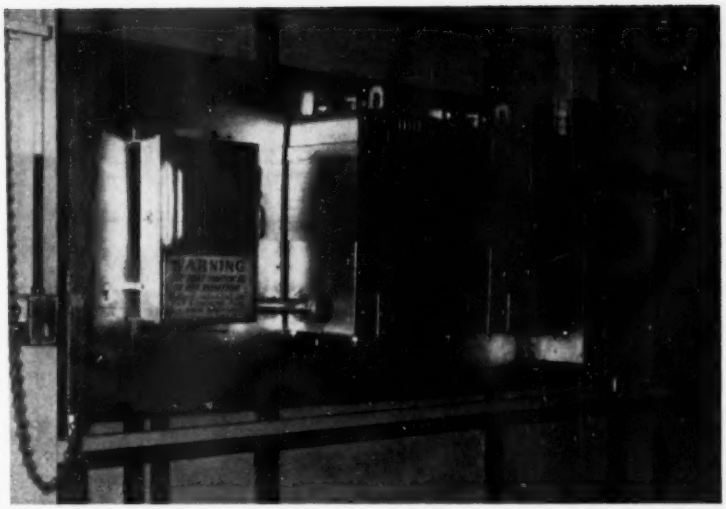
Still another innovation devised by the maintenance crew is a traffic control device positioned at the intersection of two converging belt lines. This device consists of a series of limit switches located along the side of one belt on 18-inch centers, the switches being activated by pressure exerted against piano-wire loops that extend across the line of travel. These switches, in turn, control the drive motors of the *other* converging belt so that, when packages move into the limit-switch zone of the first conveyor, movement of packages traveling along the second intersecting belt line is temporarily halted.

Heavy merchandise is moved by dolly trucks pulled along by overhead

draglines. Each dragline installation consists of an endless chain some 1200 feet in length, suspended beneath an I-beam track by means of roller assemblies. Main drives are 7½-hp 440-volt motors having manual speed adjusters. They are connected to the chains through worm and spur gears, and are controlled by stop stations positioned every 100 feet along the route. Wiring for controls runs along the top of trolley rails, and switches are suspended from brackets extending at right angles to the chain rails. These switches are on 24-volt circuits; activation of the 440-volt motor controls being accomplished through solenoid assemblies devised by ZCMI's maintenance department.

Dollies are manually connected to draglines by pushing them beneath the chain paths; actual pick-up being accomplished by dolly masts, with hooks at their tops, engaging rings fastened beneath the chains at 25-foot intervals. Dollies are automatically disconnected at their intended destinations and are shunted onto spur lines through the action of manually-set flags, automatic transfer devices, limit switches and interlocked spur-chain motors. Should a spur receive more than its intended number of dollies, an automatic alarm summons an attendant. Mechanical shock at the instant of pick-up is relieved through spring tension.

An interesting arrangement of bridge cranes and hoists is found in a high-bay steel-storage section where bar stock and structural members are delivered in car lots along a floor-recessed track entering the plant through motor-operated doors. Four bridge cranes span the four bays of this storage section, yet only two 3-ton hoists are used in the combined areas. Hoists can be shifted from one bridge to another, however, by running them from bay to bay over any one of six cross-over sections. With this arrangement, it is possible to lift and shift any load to any point in the 4-bay area by one continuous operation. When required, both hoists can be supported by a single bridge to provide a 6-ton lift. Motors for moving and lifting are 220-volt units with remote controls.



220-VOLT SERVICE, where required, is provided through dry-type transformers tapped to 440-volt feeders. Equipment is mounted on walls, keeping floors unobstructed. Mobile equipment can be temporarily powered by plugging flexible connecting cables into receptacles incorporated in the transformer enclosures.

ILLUMINATION is even and shielded by eggcrate louvers in office sections. Other sections of the plant are lighted by coves, recessed down-lights, swiveling units, open industrial reflectors and special treatments depending upon space utilization and required intensity.

Lighting Incorporates Variety

Depending upon space utilization, relative degrees of required intensity and designed objectives of functionalism or esthetic effect, lighting sources are variously incandescent or fluorescent, with fixtures including open industrial reflectors, louvered commercial units, recessed downlights, shielded strip lighting, swiveling spots and floods, coves, RLM domes and conventional bin lights. Fixtures are variously suspended from chains, stems, messenger cables, Unistrut members, trolley-duct and A-frames. They also are surface mounted or set flush in hung ceilings.

Single-, 3-way and 4-way switches are used, depending upon size of area and frequency of its use. Light levels are uniform in office sections; are raised locally over merchandise displays, inspection tables and critical seeing-task sections, and are lowered in warehouse and shipping spaces except over aisles or conveyors. Coefficients of utilization are aided throughout the plant by high-reflectance paint on walls and ceilings, light floor coverings, light woodwork and furniture. And as a result, lighting comfort is high.

This modern wholesale center is the result of intensive planning to develop the utmost in customer service and in efficiency for handling goods. These objectives have been accomplished and, to a large extent, have been accomplished through the plant-wide adoption of electrical means, methods and techniques.

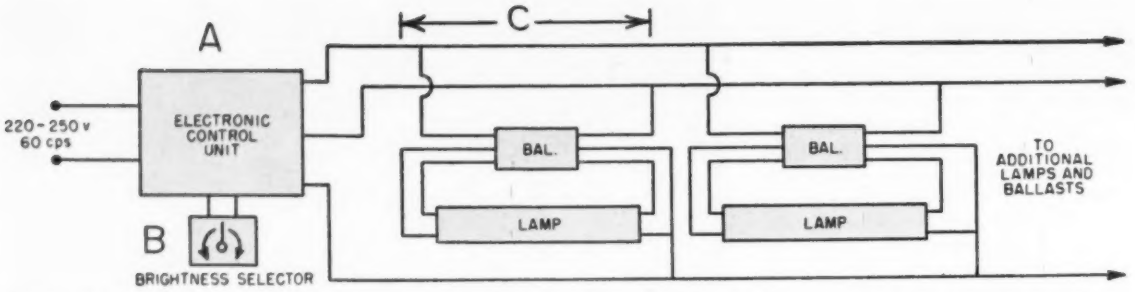


FIG. 1—Electronic dimming system for fluorescent lamps consists of control unit (A), brightness selector (B), and ballast and lamp (C). Dimming circuit is simple, and each of three parts may be remotely located from the other two.

Dimming Hot Cathode Fluorescent Lamps

Simple new three-part electronic dimming system varies the brightness of hot cathode fluorescent lamps, marks milestone in fluorescent lighting history, opens up broad new field of flexibility in color lighting and controlled light output.

By J. H. Campbell*—H. E. Schultz*—W. H. Abbott**

A NEW system of controlling the brightness of hot cathode fluorescent lamps increases the many advantages of fluorescent lighting, yet retains circuit simplicity and ease of installation. It controls the brightness of 40-watt Rapid Start or 40-watt preheat standard hot cathode fluorescent lamps smoothly and effectively over a wide range. It is based on a relatively simple electronic circuit which controls the time of an electric cycle during which voltage is applied to the fluorescent lamp.

Dimming Filament Lamps

Methods for dimming filament lamps appeared soon after the lamp was introduced, because a change in the applied voltage was the only fundamental requirement. Early methods included the water rheostat, iron wire rheostat, and the step control using tapped resistors. Improvements in the smoothness and efficiency of the control were gradually made with the introduction of variable autotransformers and thyratron tubes. The amount of light emitted is directly related to the temperature of the filament, so with voltage control the range of brightness can be considered infinite.

Dimming Fluorescent Lamps

Line voltage control is practical only for a relatively narrow range of brightness change in fluorescent lamps, due to the complex characteristics of these electric discharge lamps and their associated auxiliary equipment. Since the fluorescent lamp has a negative resistance characteristic, it requires a ballast in series to control the current. For stable operation the voltage drop across the conventional reactor ballast should be in the order of the lamp voltage. When line voltage control is used to dim the fluorescent lamp, the voltage drop across the ballast decreases with the current. For this reason, only a limited decrease can be accomplished before the circuit becomes unstable and the lamp arc extinguishes. This generally occurs at a point where lamp brightness is still 50% of normal. Even with this limited range of 2 to 1 it is doubtful whether the lamp will start at the low brightness point, because starting voltage is reduced in direct ratio.

In applications where it is desirable to have some control of lamp brightness, it is possible to operate one lamp on two ballasts of different current rating. For example, a slimline lamp can be operated at 120, 200 and 320 ma. by switching between single lamp 120 and 200 ma. ballasts, or by operating the two ballasts in parallel. Since fluorescent lamps become more efficient at low current levels, brightness changes are not in proportion to lamp current; so this system produces steps of 100%, 75% and 50% lamp lumens.

One well known control method which has been used to some extent in Europe involves the use of saturable reactors for control of ballast impedance. This system involves a reactor in series with each lamp. The reactors control the ac power to the lamps but have dc winding connected in series or multiple across a special direct current power supply. The lamp starting voltage is held constant while lamp current is varied by changing the impedance of each reactor ballast through manipulation of dc voltage. If lamp cathodes are kept hot by means

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**Specialty Transformer and Ballast Department, General Electric Co., Ft. Wayne, Indiana.

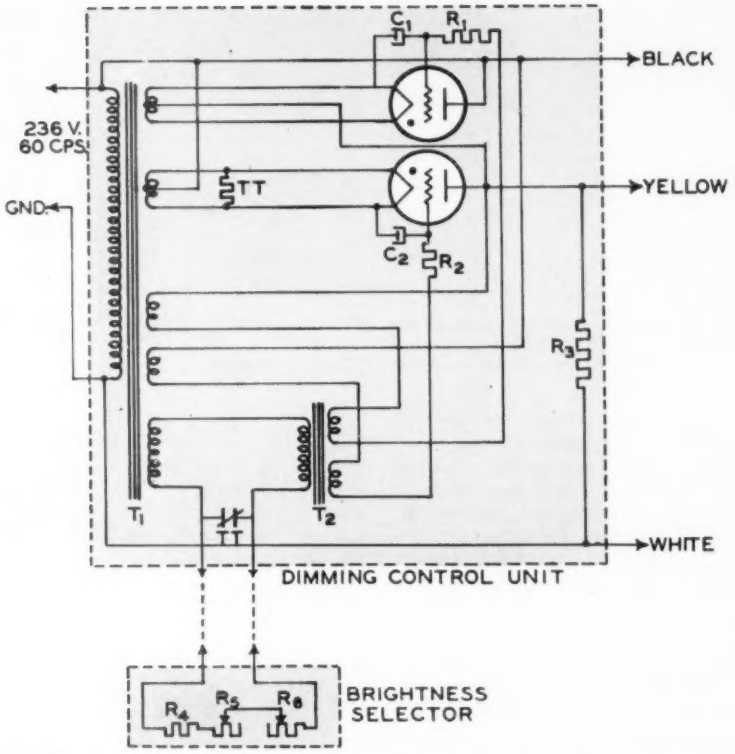


FIG. 2—Circuit diagram of dimming control unit shows how variable resistance of brightness selector shifts phase of thyratron tube grid voltage from line voltage, thus controls time that current flows through lamps during each cycle.

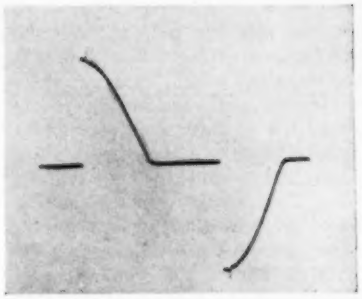


FIG. 3—Operating voltage applied to lamp circuit for the 90° conduction point, or half of each cycle.

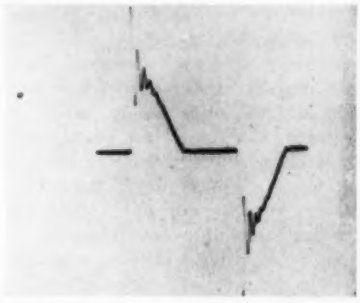


FIG. 4—Open circuit voltage applied to lamp for the 90° conduction point, showing peak voltage provided by ballast to insure starting and re-ignition on each cycle.

of separate preheat transformers, it is possible to get a wide range of lamp brightness (100 to 1 or more). This system has the disadvantage of rather complex, expensive wiring and a comparatively large and heavy ballast.

Cold cathode fluorescent lamps can be successfully dimmed by operating a number of lamps in series on a high voltage, high reactance transformer. Dimming is accomplished by varying the voltage to the primary of the transformer. This arrangement does not produce as wide a range of brightness as can be produced with hot cathode lamps, because of the relatively low maximum cold cathode lamp current. The high voltage required to start lamps in series makes it necessary to provide special lampholders to insure safety during maintenance. It also has the disadvantage of poor starting at very low levels of current since voltage available to start the lamps is inadequate.

Circuit and Lamp Requirements

When current supplied to hot cathode lamps is reduced, a point is reached where ac current is inadequate to keep the electrodes at a satisfactory electron emitting temperature. The emission for very low current is then supplemented by ion bombardment. This action strips the cathodes of active material, and short lamp life results. In view of this, lamp electrodes must be heated continuously at a temperature which will produce sufficient electron emission at any point in the dimming range.

In order to provide smooth operation, the circuit should produce sufficient voltage to start the lamps quickly at minimum as well as maximum brightness. Sufficient voltage must also be available to re-ignite the arc each half cycle to avoid flickering.

TABLE I. Comparison of fluorescent and filament lamp efficiencies for colored light.

Color	Lumens Per Watt 40-watt Fluorescent	Lumens Per Watt 200-watt Filament (Typical Filters)	Efficiency Ratio Fluorescent to Filament
White	64	18	3.5
Gold	33	15	2.2
Pink	26	8	3.3
Red	4	3	1.3
Medium Green	77	3	26.0
Medium Blue	27	1.5	18.0
Daylight	49	9	5.4

Electron Dimming Control

In the new electron dimming system for fluorescent lamps, control of the lamp brightness is accomplished by adjusting the interval of current conduction during each half cycle of the 60-cycle voltage. Two thyratron tubes are connected back to back, so that the pair of tubes will conduct current for both polarities of the ac voltage. These tubes act as a synchronous switch which closes the circuit at a predetermined point in the ac voltage each half cycle, and opens at the end of each half cycle. In this way voltage is applied to the lamp for any desired fraction of the cycle. An example of the voltage wave which is applied to the entire lamp load is shown in Fig. 3, representing the condition when the interval of conduction is set for 90°, or half of each cycle.

The abrupt rise in voltage at the leading edge of applied voltage is used to insure re-ignition of the fluorescent lamp on each cycle. The ballast for each lamp contains a choke which is

in series with the lamp to limit the lamp current. Across the lamp is a small capacitor which suppresses radio interference and resonates the sharp voltage rise at the leading edge of the applied voltage to a higher peak value to start and re-ignite the lamp on each cycle. This voltage condition is illustrated by the oscillogram in Fig. 4.

The point in the cycle at which the thyratron tube begins conducting is controlled by the grid voltage. A sine wave, variable in phase relationship to the line voltage, is applied to the grid of the tube, and the tube will fire or conduct when its plate is positive with respect to the cathode and its grid voltage is essentially zero. In the circuit diagram of Fig. 2, each grid derives its voltage from two coils in series—one on T_1, which is constant in voltage and phase, and one on T_2 which is variable in voltage and phase. The sum of these two voltages results in a sine voltage of constant amplitude but variable in phase relationship. In this way the point in the cycle at which the grid is zero volts with respect to the cathode can be controlled.

A vector diagram of the grid circuit is shown in Fig. 5. Vector AC represents the phase of the applied line voltage. V_L is the voltage of one of the secondaries of T_2, and V_1 the secondary voltage on T_1 in series with V_L. V_R is the proportional drop across the total resistance in series with the primary of T_2. The voltage OB is applied to the grids of the tubes, properly phased for control. Point B will follow the semi-circular locus as R is varied, resulting in complete 180° control of the conduction angle.

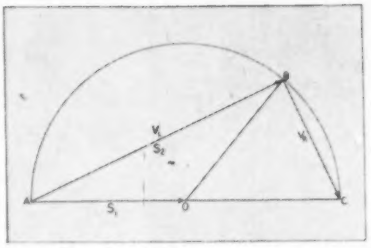


FIG. 5—Vector diagram—grid circuit voltages. Point B follows semi-circular locus as resistance in selector is varied.

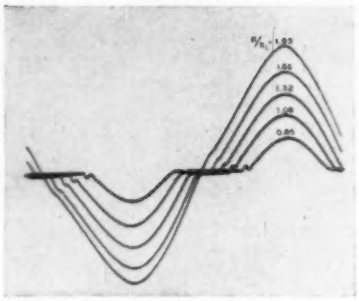


FIG. 6—Current waveshape corresponding to 20%, 40%, 60%, 80% and 100% brightness.

The control elements of the circuit (Fig. 2) are resistors R_6 and R_4, one of which can be adjusted so the lamps will not be taken below the minimum brightness, and the other selects the brightness at any point in the range. Rotating the control changes the resistance in series with the primary of T_2. Since both tubes are controlled by the secondaries of T_2, this single control regulates both tubes.

A small capacitor (C_1 and C_2) is connected between grid and cathode of each thyratron tube to suppress line surges. Without suppression these surges can cause the tubes to fire prematurely in the cycle, giving a flash of light. The resistors R_1 and R_2 are used to limit the grid current to a small value while the grids are positive. R_5 tends to stabilize the lamp operation at very low levels by draining off any residual charge from the yellow line after each pulse of current.

The angle at which the tubes start conduction is a function of the ratio of the sum of R_4, R_5, R_6 and the primary resistance of T_2, divided by the inductive impedance of the primary of T_2.

The entire cycle of current waveshape for five ratios of R/X_L are shown in Fig. 6. The R/X_L values are 0.85, 1.08, 1.32, 1.65 and 1.93. These points correspond to the 20%, 40%, 60%, 80% and 100% light output points. The light output waveshapes for these values of R/X_L shown in Fig. 6 are given in Fig. 7. The

Electronic Dimming Now Available

Availability of equipment for the practical dimming of fluorescent lamps smoothly and efficiently has been announced recently by the General Electric Company. This is something the lighting industry has been striving for since the inception of fluorescent lighting 15 years ago, and heralds a new and expanded field of flexibility of light control, especially in the field of mobile color lighting.

Since this new fluorescent dimming system involves a new electronic control circuit, broad application of the system will hinge upon full knowledge of the design and theory of operation of this circuit. Thus the engineers who designed the circuit making this new control system possible were invited to outline the fundamental theory and operation of the circuit. This is done in the accompanying article.

The General Electric fluorescent lamp dimming control has three parts, each of which may be located remote from the other two (Fig. 1—A, B and C). The dimming control unit is one part, the intensity control is the second, and the ballast and 40-watt lamp is the third.

The ballast, which would be conventionally located in the luminaire, has two functions: to limit the lamp current in the usual way, and to supply low potential power to heat the lamp cathodes continuously. Three leads must be brought to the ballast from the dimming control unit. The ballasts are connected in parallel, the maximum number depending on the rating of the dimming control unit.

Two models of the dimming control unit are available. One will control any number of 40-watt preheat fluorescent lamps up to 35, and the other will control any number up to 8. Both models operate from 236-volt 60-cycle supply lines. The heart of each unit is a pair of industrial thyratron tubes. The principal difference between the two models is the size of these tubes which determine the maximum number of lamps each unit will control. To protect the thyratron tubes in the control unit during initial operation, a time delay device "warms up" the tubes (TT in Fig. 2). Both models are the same size in physical dimensions and may be racked side by side, or panel mounted side by side. Each model has a completely enclosed terminal box built in and provided with standard knock-outs for leads.

The intensity control is essentially a variable resistance. Its purpose is to set the time at which the thyratrons "fire"

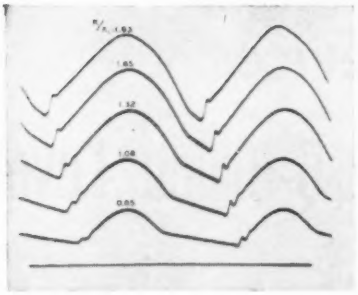


FIG. 7—Light output waveshapes corresponding to the points of Fig. 6.

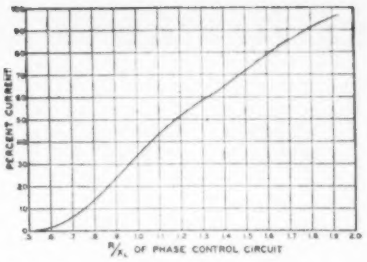


FIG. 8—Current increases as the R/X_L ratio increases.

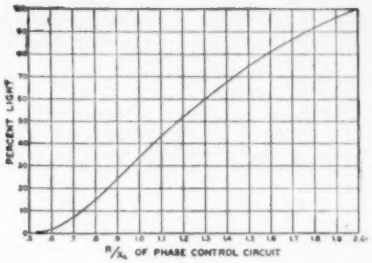


FIG. 9—Light output increases as the R/X_L ratio increases.

bottom line in Fig. 7 is the zero light reference level. Figs. 8, 9 and 10 show the relation of the rms lamp current, average light output, and conduction angle, versus this ratio of R/X_L respectively.

Lamp flicker at full light output corresponds to single lamp operation with conventional ballasts. The percentage flicker as measured by photocell instruments increases as the lamps are dimmed. However, lamp flicker becomes less apparent to the eye as brightness decreases, with the result being essentially the same at low brightness on the dimming circuit as conventional operation at full brightness.

Wiring Details

The electronic control unit uses power supplied by a nominal 236 volt single phase line. Only three wires (Fig. 1) are required to deliver power from the control unit to the lamp load. One common and one control line are needed to supply voltage for lamp arc current. The third wire by-passes the control to provide the cathode preheat transformers in the ballast with line voltage, thus maintaining constant cathode temperature over the entire dimming range.

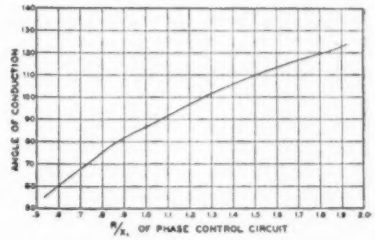


FIG. 10—Conduction angle increases as the R/X_L ratio increases.

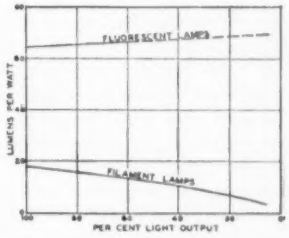


FIG. 11—Effect of dimming on lamp efficiencies for white light.

Lamp Ballast

The lamp ballast consists of a series reactor for arc current control, and

(*Continued on page* 192)

and pass current to the fluorescent lamps. The variable resistance is rather low in value (less than 1000 ohms), hence the remote control lines are not likely to pick up stray signals to affect the brightness level of the fluorescent lamps. The intensity control operates at 25 volts or less, and is electrically isolated from the 236 volt supply lines. It may be used with either model of the dimming control unit. Several units may be controlled by one intensity control, but the variable resistor must be proportionately larger in wattage rating. More elaborate control methods using variable resistances may be devised to suit the needs of special applications. Special controls might make use of a selsyn-driven potentiometer to provide automatic control in either direction, or a push-button unit with fixed resistors to provide pre-selected brightness.

Electronic dimming can be applied to existing 40-watt preheat type fluorescent lighting installations. All that is required is to pull out the old ballasts, install the new ones (one for each lamp), connect to the dimming control unit, and add a suitable brightness selector. However, existing fluorescent lighting installations in general have not been designed for dimming control. The addition of dimming equipment to these installations cannot, therefore, be expected to provide the full flexibility and range of decorative effects inherent in this new development.

The most effective use of the new electronic fluorescent dimming equipment will be made in new lighting installations, designed to incorporate the many advantages of color lighting. For example, for equal chromaticity approximately 20 red fluorescent lamps are required for each green fluorescent lamp; or eight medium blue fluorescent lamps for each gold fluorescent lamp. There is also the possibility of combining filament and fluorescent lamps in the same mobile color system for unusual and dramatic lighting effects. There will also be many applications for use of variable intensities of white light, or for the blending of existing white fluorescent light sources for specific color quality of the illumination, as for example, in a rug or furniture store. Specialized knowledge is required for the design of harmonious color lighting effects. But for the lighting engineer who has this specialized knowledge of color and its application in lighting, the availability of this new electronic dimming system for fluorescent lamps opens up new and unlimited possibilities.

Editor

Thanks to newer devices

1952 Appliance Sales Maintain $6-Billion Level

Dryers, freezers, air conditioners and TV make big enough gains to compensate for continuing slide of refrigerators, ranges and water heaters.

By Robert W. Armstrong

Managing Editor, "Electrical Merchandising"

AS USUAL, the appliance industry had an "abnormal" year in 1952. It was unusual in several respects: in a better supply of materials than had been expected; in the joining of the battle among manufacturers for full-line supremacy; in the removal of credit and TV station restriction; in the continuing growth of discount houses, trans-shippers, and the like; in the development and introduction of some really new devices; and in the fact that while sales of several standard appliances declined, others, both old and new, gained enough to maintain total dollar volume close to the 1951 level.

To some extent, 1952 sales repeated the 1951 pattern. Refrigerators, for example, which had declined 34% in 1951, were off again in the year just past. So were ranges, water heaters and others. According to *Electrical Merchandising* for January, refrigerator sales, with 3,570,000 units, were off 12.4%. Among those appliances requiring special wiring, ranges and water heaters were hardest hit. The 1,060,000 ranges represented a 24.3% decline and water heaters, with 720,000 units, were off 14.8%.

Balancing these losses were substantial gains by clothes dryers, water systems and air conditioners. Dryers, both electric and gas, continued their race for public acceptance with total sales of 610,000 units, a gain of 24%. Electric models reached a figure of 440,000 units, a gain of 24.3%, while gas models, with sales of 170,000, went ahead 23.2%. Air conditioners, held back only by limited supplies during the record hot-weather boom of last summer, jumped 42.7% to a total of 341,000 units. Water systems made an 8.8% gain for sales of 680,000 units.

Judging from the 1951 pattern, it was expected that most of those new appliances which made gains in that year would do so again in 1952. For air conditioners, freezers and dryers this held true. Freezers which went ahead 8.6% to 1,140,000 units, had the additional help of the suddenly powerful and booming food plans to counteract what otherwise might have been a slight decline. Dishwashers and garbage disposers, on the other hand, had no such assistance and the downward trend which they had resisted in 1951 caught up with them in 1952, pushing dishwashers down 19.2% to 210,000 units and garbage disposers down 21.9% to 275,000 units.

What Kind of a Year

The overall record of 1952 is surprising in view of the fact that it got off to such a poor start. The reaction from the over-buying of the Korean boom was still in effect during the early months and the nation's dealers and distributors spent most of the first half struggling with inordinately heavy inventories, inventories which they all too frequently liquidated at a considerable loss in profit. The problem was so acute during the early months that some refrigerator manufacturers, for example, resumed production of 1951 models so that they could offer "specials" that would sell where 1952 models would not. These top-heavy inventories, widespread price-cutting and other factors, such as a smaller proportion of dealers who could live off their service operations, made it tough going for the nation's retailers and, obviously, created a certain amount of dealer failure. However, according to 167 of the nation's utilities who reported on the number of dealers in their territories in both 1951 and 1952, there was practically no change in the total number of merchants, an opinion which differs sharply with some other estimates of a net decline of as much as 10,000 dealers.

Construction of some 1,100,000 new homes during the year helped expand the retailers' market to a new high of 42,306,600 wired homes from the 1951 total of 40,967,180. Their best market of the nation's nine regions continued to be the East North Central States, which, with 20.93% of domestic customers, absorbed 19.78% of washer shipments, 29.48% of ironers, 35.48% of dryers, 18.56% of refrigerators, 17.11% of ranges, 20.49% of water heaters, 17.46% of freezers, 22.69% of TV, and 19.20% of radios. The Middle Atlantic States were a better market for refrigerators, accounting for 20.34% of sales, the South Atlantic States took more ranges, 24.50% and more water heaters, 26.99%, but, overall, the East North Central region provided the biggest market. (See table).

Replacement Sales More Important

Replacement and trade-in sales, as reported by the 246 dealers responding to *Electrical Merchandising's* survey, show some interesting reflections of the 1952 picture. Only 7% of freezer sales, for example, were replacement sales, a 3% decline from the previous year and indicating that dealers and food-plan operators were finding new customers with their expanded operations. Ranges, on the other hand, jumped from a 1951 percentage of 35% replacement sales to 44% in 1952, an increase which might logically indicate a decline in woods-combing and doorbell-ringing and a reliance for sales on those people who already owned electric ranges. A slight increase from 66% to 73% replacement sales for washers reveals the increased acceptance of automatic models which are being sold to replace conventional types. And the sales figures for the year bear this out: for the first time in history automatic washers outsold

How Appliances Sold in 1952 and 1951

Product	1952 Number Sold	1952 Retail Value	1951 Number Sold	1951 Retail Value	% Change Units	% Change Value
Air conditioners, room	341,000	$ 122,760,000	237,500	$ 86,687,500	+ 42.7	+ 40.7
Bed coverings	830,000	35,275,000	776,000	32,980,000	+ 7.0	+ 7.0
Cleaners, vacuum (floor)	2,855,000	261,289,600	2,729,100	234,893,600	+ 4.6	+ 11.2
Dehumidifiers	90,000	12,870,000	75,000	10,875,000	+ 20.0	+ 18.3
Dishwashers	210,000	63,000,000	260,000	78,000,000	— 19.2	— 19.2
Disposers	275,000	35,750,000	352,000	47,520,000	— 21.9	— 24.8
Dryers (elec. & gas)	610,000	157,100,000	492,000	120,679,500	+ 24.0	+ 30.2
Fans						
Attic	80,000	11,200,000	90,000	12,325,500	— 11.1	- 9.1
Vent. & window	775,000	36,553,500	665,000	29,232,500	+ 16.54	+ 25.04
Freezers	1,140,000	421,800,000	1,050,000	378,000,000	+ 8.6	+ 11.6
Heaters, space (elec.)	1,202,000	31,203,000	930,000	12,393,000	(not comparable types)	
Ironers	207,500	43,367,500	283,840	49,572,700	— 26.9	— 12.5
Radios						
Home	3,601,770	123,360,600	6,751,400	231,235,500	— 46.7	— 46.7
Portable	1,367,310	42,386,600	1,332,990	41,322,700	+ 2.6	+ 2.6
Clock	1,630,300	64,396,800	777,000	30,691,500	+109.8	+109.8
Ranges	1,060,000	270,300,000	1,400,000	350,000,000	— 24.3	— 22.8
Refrigerators	3,570,000	1,017,450,000	4,075,000	1,120,625,000	— 12.4	— 9.2
Washers, electric	3,145,000	685,574,400	3,384,700	715,663,000	— 7.1	— 4.2
Water heaters, storage	720,000	95,040,000	845,000	114,075,000	— 14.8	— 16.8
Water systems	680,000	110,160,000	625,000	96,875,000	+ 8.8	+ 13.7
Television	6,000,000	1,691,988,000	5,384,800	1,658,500,000	+ 11.4	+ 2.0

Courtesy *Electrical Merchandising*

Appliance Sales by Regions in 1952

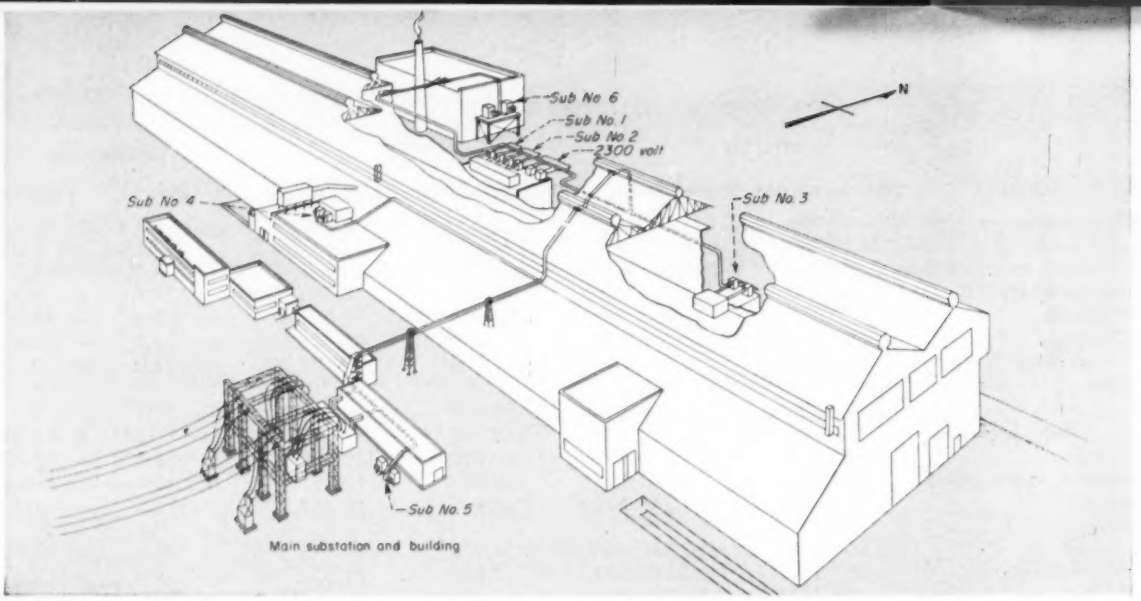
	Residential & Rural Electrical Customers	Shipments by Percent of U. S. Total, 1952									
	Jan. 1, 1953	% of U. S. Total	Washers 8 mos.	Ironers 8 mos.	Dryers 8 mos.	Refrig-erators 9 mos.	Ranges 9 mos.	Water Heaters 9 mos.	Freezers 9 mos.	TV 9 mos.	Radio 9 mos.
New England	2,833,733	6.70	6.26	4.89	4.15	5.51	6.84	5.69	2.62	7.42	5.92
Middle Atlantic	8,616,840	20.37	18.34	21.00	18.84	20.34	13.32	15.53	13.37	24.43	21.93
East No. Central	8,854,844	20.93	19.78	29.48	35.48	18.56	17.11	20.49	17.46	22.69	19.20
West No. Central	4,074,038	9.63	8.33	10.60	12.53	8.59	7.94	10.80	13.49	7.28	9.03
South Atlantic	5,425,511	12.82	14.65	8.95	5.42	16.53	24.50	26.99	12.79	12.00	14.44
East So. Central	2,689,426	6.36	6.64	2.26	1.88	7.79	11.78	7.49	6.16	4.21	6.06
West So. Central	3,767,236	8.90	9.99	6.22	2.77	10.52	4.05	1.93	11.22	7.72	10.10
Mountain	1,439,220	3.40	3.56	4.33	3.18	2.94	4.48	4.22	5.75	2.25	3.74
Pacific	4,605,750	10.89	12.45	12.27	15.75	9.22	9.98	6.86	16.94	12.00	9.58
United States	42,306,598	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

conventional types in both units and dollars. Ironers, which have always suffered because they must be intensively sold, revealed their weakness with a replacement sales figure of 13%, abnormally high for an appliance with a saturation of only 9.2%. Replacement sales have even become important in television, attaining a percentage of 35.5 in 1952 as compared with 12.3 in 1951.

The Outlook for 1953

This year promises in many ways to be a repetition of 1952. It seems logical to expect that some of the newer appliances, such as dryers, will continue to gain acceptance while many older products will, at best, hold even. However, with many makers producing full lines and struggling to capture what they believe is their share of the market, no real stability is likely. Some new products will operate in the dealer's favor. Now he has a combination washer-dryer to add to his lines; soon he will have an electric range with thermostatically controlled surface units; canister type vacuum cleaners will enlarge their acceptance; UHF television is already here and spreading fast; experimental radio and TV sets using transistors in place of tubes have been made and tested; upright freezers are displacing chest models; refrigerators have added some important new developments.

Overall, 1953 is likely to produce approximately the same dollar volume as 1952, but in a different pattern. Sales last year were off the first half, up the second. This year it is more likely that sales will be strong in the first and last quarters, off in the middle quarters. Whatever the pattern, it is certain that with unrestrained production and the present high saturation on many standard appliances the dealer is going to have to watch his inventory, find new ways to sell at list prices and cultivate low-saturation products if he wants to come through the year with an undamaged reputation and a reasonable profit.



ISOMETRIC VIEW of plant showing new high voltage distribution system. Note cable bridge between main substation and manufacturing building where load center substations are located.

Installation Time For . . .

MODERNIZED Distribution System

. . . was substantially reduced by using armor cable feeders on open racks at Ford Motor Company's Canton Forge Division

By D. L. Westhoeffer
Electrical engineer
Hilscher-Clarke Electric Company
Canton, Ohio

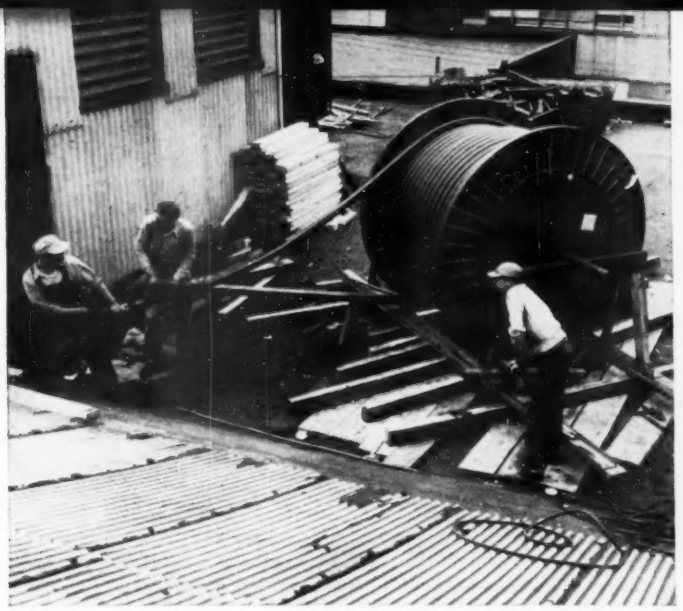
WITHIN a comparatively short time after the Ford Motor Company acquired the plant which now houses its Canton Forge Division in Canton, Ohio, management faced a serious bottleneck. Power demand had more than doubled and the existing transformer and distribution system was woefully inadequate. Modernization was the answer with "time" an all-important controlling factor. Rewiring had to be done as quickly as possible. Production had to be maintained during this period with an absolute minimum of "down time".

Design of new distribution facilities to meet these requirements resulted from collaboration of Ford engineers, Hilscher-Clarke Electric Co. (electrical contractors) and cable and apparatus specialists of the General Electric Company. Now the Forge Plant is served by a main bank of two 10,000-kva, 3-phase, 23-kv/13.8-kv transformers; a 13.8-kv feeder system; and six load center substations located throughout the building. A typical load center consists of two 1500-kva, 13.8-kv/480-v transformers and metal clad switchgear for secondary distribution. Switchgear design includes spare capacity for a 50% increase in the present load.

With the installation time problem in mind, the engineers gave careful consideration to the type of feeders used on the 13.8-kv system. After weighing all possibilities they chose 3-conductor, 15-kv, 500MCM interlocked armor cable (varnish cambric insulation, polyvinyl chloride jacket under bronze armor) mounted on light-weight, open, ladder-type racks suspended from or supported by brackets on the building exterior. This decision was based upon several advantages the cable offered for this specific application.

Among them were:

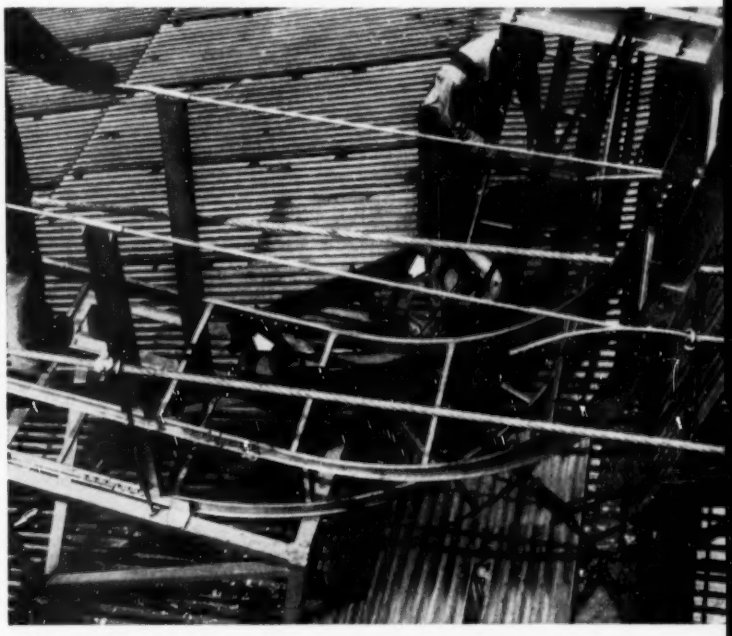
1. Cable installation ease (time factor) and hence low installa-



FEEDER PULL STARTS at reel set up near substation location. Reel crew starts 500 MCM, 15-kv., 3-conductor armor cable on its way from the substation, up the lower sloping roof of the main building toward . . .

CABLE RACK ENTRANCE on building exterior. After cable passes through aluminum sheaves (arrows) and over rack rollers . . .

TRAVELER FOLLOWS feeder along rack to prevent snag of cable grip (arrow) on rollers. Feeder moves on to its next change of direction on the . . .



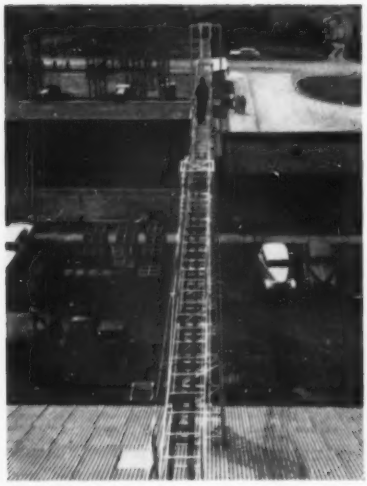
LOWER DECK entrance to twin-deck suspension bridge. Triple-pulley device (arrows) guides cable in easy sweep around bend. Upper deck rack goes up and over building to another substation.

tion cost compared with other methods.

2. Above ground cables are easily accessible for visual inspection, maintenance and future change.
3. There would be no possibility of grounds or cable failure developing due to vibration (nature of work in building) as might occur on conduit and cable feeders—particularly at pull box locations where friction develops.
4. Long feeder runs, even with numerous offsets and right-angle bends could be installed without splices.

Lightweight Stacey racks were first installed along the entire feeder route. When mounted to building exteriors, the racks were either rod-suspended from channel-iron "arms" welded to the building steel, or supported by triangular brackets—whichever was most practical. Where racks spanned open areaways, they were supported by simple catenary suspensions. Once the rack system was completed, the cable was pulled in with relative ease and speed.

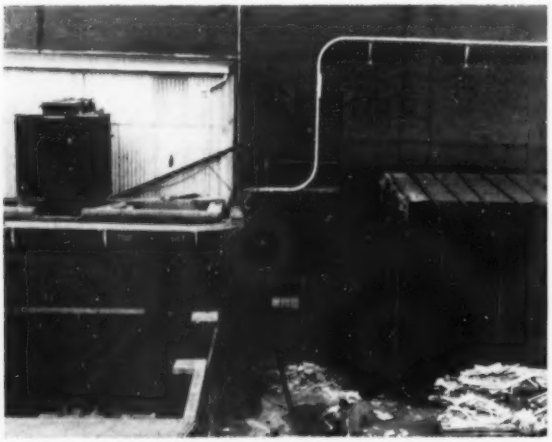
Hilscher-Clarke engineers anticipated that the biggest pulling problem would occur at the numerous 90-degree bends in the rack system. To



CABLE CONTINUES along lower deck of suspension bridge to switch-gear building served by main transformer station in background.

AT BRIDGE TOWER another triple-pulley device guides feeder around a 90-degree bend. Second set of pulleys at base aligns pulling cable with winch.

FEEDER PULL ENDS at winch truck stationed at base of tower. Men at winch were guided by signals relayed by "cable watchers" along feeder route.



CABLE RACK SNAKES around building obstructions to carry feeders to outdoor substation. Run has four 90-degree bends

SMALL CATENARY suspension carries cable rack across open areaway between plant buildings.

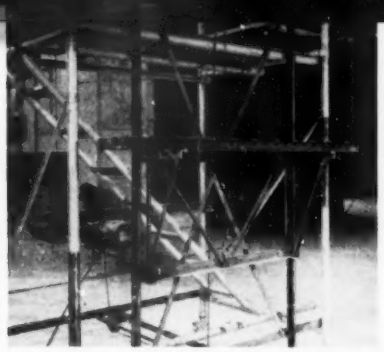
overcome this, they designed and built a number of single and multiple cable sheave assemblies with sheave diameters ranging from 12 to 16 inches. The multiple units were used at right angle bends; consisted of a flat-triangle shaped angle-iron frame with three aluminum sheaves mounted in tandem. The center sheave was offset enough to provide a smooth long cable sweep around the bend. Removable rollers were installed at intervals along the horizontal racks to reduce cable friction during the pulling operation. Pulling power was provided by a winch on the contractor's truck.

With this arrangement, the cable-pulling chore was reduced to a simple, easy, fast operation. Spot checks made during installation bear this out. A 750-foot feeder run with 13 bends was pulled in about 30 minutes. Pulling time for a 500-foot run with several 90-degree bends was approximately 25 minutes. Other pulls varied with length of run and number and complexity of offsets.

A basic cable-pulling crew included five men: two on the reel, one "traveler" along the cable route, and two men on the truck winch. When numerous bends were involved, the crew was supplemented by the addition of one man at each bend to watch cable movement over the sheaves. This was particularly important at points where feeder direction changed from horizontal to vertical and vice versa.

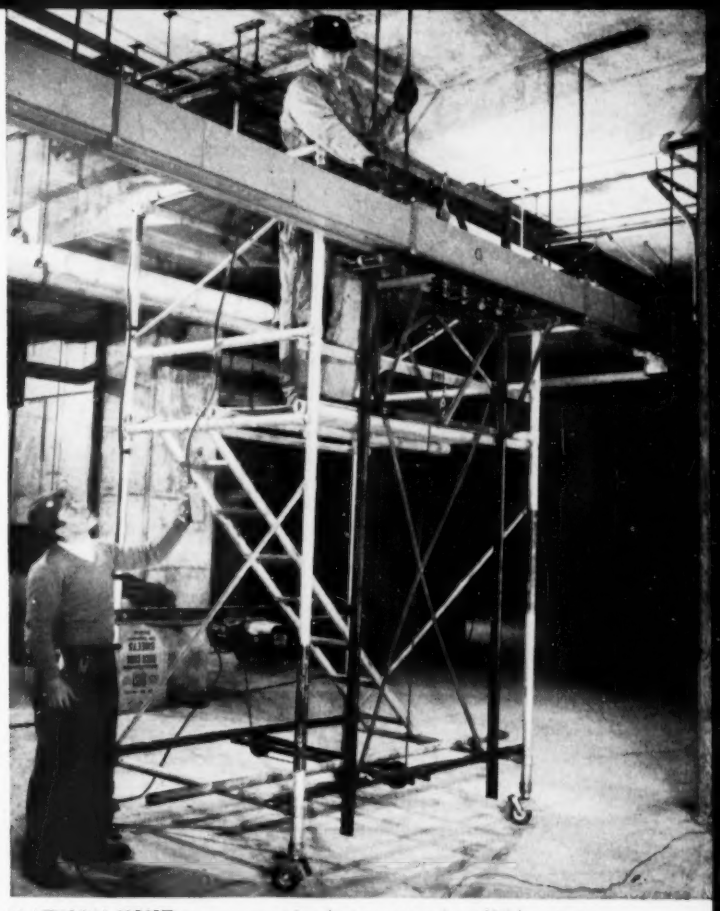
After removal of the temporary rollers on the racks, the cables were clamped to the "rungs" at 36-inch intervals along horizontal runs and 18-inch intervals on the vertical sections. At substation points, the feeder cable was simply dropped between the rungs to the transformer location. Cable terminations at indoor substations were made without potheads; consisted of simple, taped stress cones. The entire cable rack system is wide enough to accommodate a number of future feeder cables.

The combined cooperation and engineering efforts of all concerned were responsible for the speed with which this distribution system was modernized. Problems were anticipated and solutions made well in advance of actual installation. In general, the job was completed without a hitch.



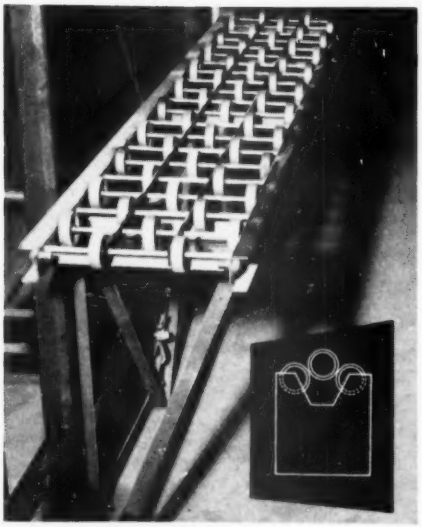
CLOSEUP OF HOIST construction showing angle-iron base, vertical channels and hoist motor in background.

Scaffold-Mounted PLATFORM HOIST



PLATFORM HOIST mounts to side of conventional scaffold; raises bus duct to installation position. Hoist motor can be controlled from floor or scaffold position.

. . . takes the drudgery out of bus duct and heavy conduit installation on Harlan Electric Company projects.



WHEEL CONVEYOR section serves as hoist platform for bus duct work. Duct sections are rolled onto conveyor. For conduit, special end-plates with ball bearings (inset) are added.

IF THERE is any piece of equipment on the market, power-driven or otherwise, that will simplify installation of an electrical system—and incidentally cut installation time—Harlan Electric Company will have it on the job. Should an installation problem arise with no suitable equipment available, Harlan engineers will solve it by designing and building their own unit. And it pays off on the right side of the ledger. Such a tool-conscious approach by management has paved the way for the substantial growth of this Detroit electrical construction firm.

A typical Harlan time-saving application is an electrically-operated platform hoist mounted to one side of a standard, collapsible, light-weight ("Up-Right") scaffold. This unit has the interest of the mechanic at heart. It was designed to raise heavy bus duct and conduit into position and hold it in place during installation. All the mechanic on the scaffold need do is connect the bus duct or conduit section to that already in place. There is no weight to support or shift.

For bus duct work, the hoist platform is a section of standard wheel conveyor so duct sections can be easily rolled onto it. For conduit work, steel end-plates with a V-cut and ball-bearing wheels at the top are attached to the hoist platform.

The platform base rides in vertical steel channels welded to angle-iron cross-pieces. These, in turn, are fastened to the scaffold frame with U-bolts. On the opposite side of the scaffold, near the base, the hoist motor is mounted in a similar manner and acts as a counter-weight to the off-balance created by the platform. An "up"-"down" pushbutton station at the end of a long flexible cable controls the motor and can be operated from the floor or scaffold.

The complete hoist unit can be dismantled and transported from job to job with the collapsed scaffold.

Adjusting Feeder Conduit Units For Job Conditions

By Ray Ashley
Research and Consulting Engineer
Chicago, Illinois

QUESTION: *How much must standard labor units for feeder conduits be increased to compensate for the excess labor required when working in operating sections of manufacturing plants?*

ANSWER: *The standard labor units (for unoccupied areas) should be increased 50 percent when feeder conduits are to be installed in factory areas already occupied by operating machinery.*

DISCUSSION: The answer "50 percent" is given because it represents the required increase—or adjustment—of labor units for the type of installation one ordinarily has in mind when talking of occupied manufacturing areas (sections with production machinery already in operation). Other areas also are to be considered. To qualify the foregoing answer, an area devoted to bench work will also be studied.

First, consider the spaces with operating machines. The accompanying table lists all the individual labor items which go into a conduit installation and points up those specific items where excess labor should be added to standard units. Column 1 is taken from the Table on page 52 of "Electrical Estimating" (McGraw-Hill Book Co.). The data in Columns 2 and 3 are based on other field studies.

The first increase shown in Column 2 is sub-item 1-A, "Making special arrangements for storage". This covers time spent with plant management picking out suitable spaces, plus time for arranging deliveries to suit plant conditions.

Item 3, "Moving materials from storage to installation points", is increased 50 percent in Col. 2 for two reasons: (1) Care must be exercised to avoid interference with plant operations; (2) materials are delivered to the job piecemeal. Practically all other increases are due to working around or over operating machinery. Generally, main conduit runs are along aisles or passageways. However, presence of workmen and handling of materials greatly slows down the job progress. This hazard is principally reflected in the actual installation cost.

Double Installation Time

Although the Total Installation Time (items 1 through 11 in Table)

COMPARATIVE CONDUIT STUDY BETWEEN STANDARD AND ADJUSTED UNITS

Installation time (man-hours per 100-ft.) for 1½-inch rigid steel conduit on a 12-foot ceiling. Fastenings and hangers not included.

ITEMS OF LABOR	UNOCCUPIED SPACE (Standard Units) Col. 1*	OCCUPIED SPACES—FACTORY (Adjusted Units)	
		OPERATING MACHINES Col. 2	BENCH WORK Col. 3
1. Study time	0.40	0.40	0.40
1-A. Making Special Arrangements for Storage and Work Program	—	0.25	0.20
2. Unloading and Delivering to Storage Space	0.40	0.50	0.50
3. Moving from Storage to Installation Point	0.40	0.60	0.50
4. Laying out Runs and Measuring for Nipples	0.90	1.40	1.10
5. Tools—Setting Up and Handling	0.30	0.50	0.40
6. Cutting Conduit—includes Measuring 3 cuts per 100 ft.	0.80	0.80	0.80
7. Threading—includes necessary Cleaning—5 threads per 100 ft.	2.40	2.65	2.50
8. *Installing Conduit*—not including offsets and elbows	2.50	5.00	4.50
9. Installing Elbows—2 per 100 ft.—not including measuring	0.80	1.60	1.35
10. Offsets—making and installing	1.75	2.25	2.00
11. Connections at Pull Boxes or Cabinets 2 per 100 ft.	0.35	0.35	0.35
TOTAL MAN-HOURS per 100 ft.	11.00	16.30	14.60

Notes:

*Col. 1 — Values used in this column are for work in connection with a complete electrical installation. *For isolated conduit runs values would be greater.* Units in Col. 1 are from "Electrical Estimating," McGraw-Hill Book Co., page 52.

Col. 2 and Col. 3 — Units in these columns are derived from field studies.

Item 8, Col. 2 — Note that the time for actually mounting conduit is 100 percent greater than standard unit in Col. 1, while the overall total for all operations is about 50 percent greater (bottom of table).

for all operations involved in installing a conduit system is increased only 50 percent (Col. 2, bottom), the specific operation of mounting the conduit in place (Item 8) is up 100 percent. This is the part of the work carried on entirely in the active—or operating——plant areas. Other specific items show no change in the Table.

The standard conduit labor unit (Col. 1, total) is 11 man-hours per 100 feet. When runs are installed in operating machinery areas, this unit jumps to 16.30 man-hours per 100 feet (Col. 2, total). This is an increase of 48 percent. In practice, the value "50 percent" is commonly used. In plants where gases or fumes are present, a special allowance must be made.

Data for Bench Areas

Comparative data for working over benches are shown in Col. 3 of the Table. Total time is 14.6 man-hours—an increase of 32% over the total in Column 1. These are conservative figures. Where bench work is carried on, material movements are limited and the hazard of operating machinery is not present. For very favorable conditions (wide aisles and temporary shifting of plant workers) the values might, in some cases, be reduced.

This study has been limited to conduit installed on a 12-foot ceiling. High ceilings introduce other difficulties which must be appraised according to job conditions. Branch lighting circuits over machinery is another subject involving outlet boxes as well as conduit. It will be discussed in a later article.

Common Code Problems

answered by **B. J. McDonald**

Sprinkler Ground

QUESTION: I have a question arising in regard to grounding electric system on a government warehouse in a supply depot. This warehouse was built during World War II and has open feeders running to service switches and panels and in many instances, the switches are bonded to the neutral of the 4 wire, 3 phase system The lighting panels are not grounded.

We have an overhead wet type sprinkler system in all warehouses. The question arises about using it for grounding.

1. Can the sprinkler system be used for grounding the electric system?
2. If so, can we use a short run of wire from each switch or panel to branch line of sprinkler system?
3. Or must we run a ground between each panel and switch and connect to one common ground at water main?

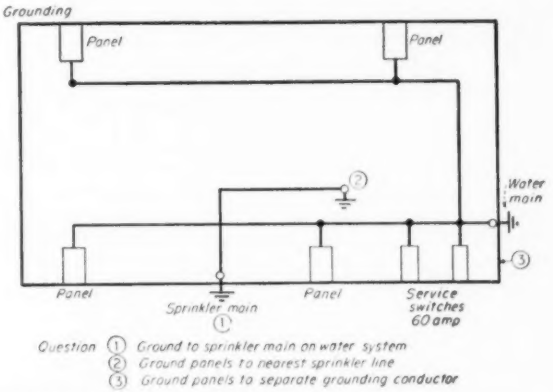
I believe that the latter is the right way to do the grounding although I find nothing in the Code barring us from connecting to the sprinkler system. R. R. E.

ANSWER: In answer to your question, I assume that the service is 3 phase, 4 wire WYE connected; that the neutral conductor of the service is grounded to the water pipe system; and that the equipment, such as panels, is not grounded except possibly the service equipment.

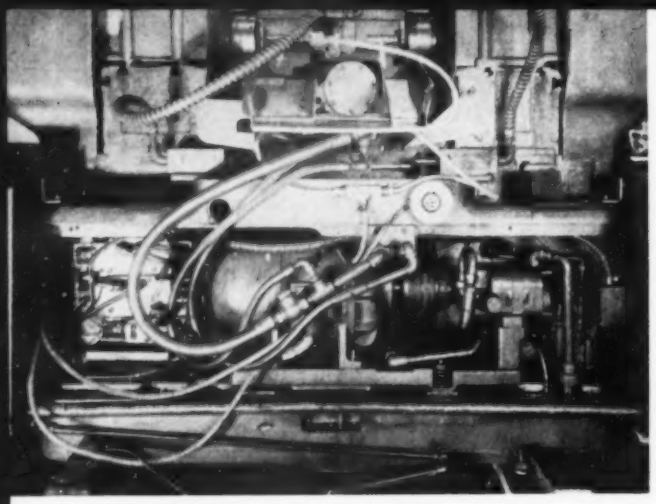
1. While there appears to be no specific Code reference to the use of a sprinkler system for use as a grounding electrode, it is my experience that sprinkler engineers and inspectors will not permit the use of their system for such a purpose unless all grounding connections are made on the street side of the main valve, to an underground reliable water works system, provided no other metallic underground water piping system is available. The characteristics involved with the construction of a sprinkler system vary considerably in line with the source of a water supply and the maintenance of same presents problems which are not common to an ordinary water supply. Testing, drainage, fire department connections, gravity tanks and pressure tanks are some of the features involved which raises a question of use as a reliable grounding electrode. As a result, my answer to this question is keep off the sprinkler system especially where a general use water piping system is available.

2. Since the answer to No. 1 is No, it follows that you also could not ground your panels to adjacent sprinkler lines. At the present time, the system and service equipment is grounded to the water system through a common grounding conductor. To ground the panels to the sprinkler lines would violate Section 2554 of the Code, which requires that where a common ground electrode is used, all grounding connections shall be made to this common electrode.

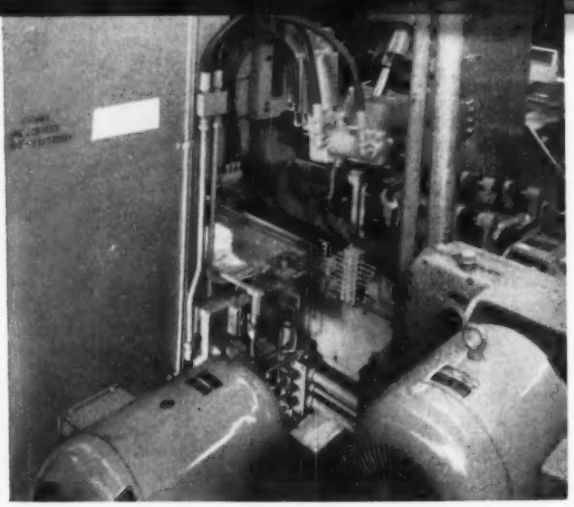
3. I fully agree that the proper way to ground the panels is to run a separate grounding conductor from the equipment involved to the service grounding connection on the water pipe system. B. A. McD.



PROBLEM of grounding panels and switches on an open 3 phase, 4 wire feeder system.



TYPICAL PRE-JIC machine tool. Note excessive use of flexible conduit; wiring and solenoids in base exposed to oil contaminates; difficulty of servicing motor or replacing belts.



NEAT ARRANGEMENT of lubrication, hydraulic and electrical components make each device available for servicing. Note easily accessible motors driving multiple drill head (right).

JIC Standards bring . . .

More Safety and Less Maintenance

. . . to highly automatic machine tools used in the automotive and other mass production industries.

By R. W. Kowitz

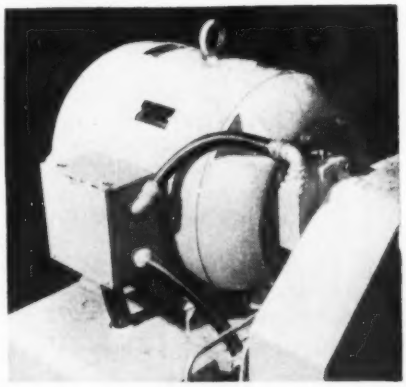
Manufacturing Engineering Office
Ford Motor Company
Dearborn, Michigan

OUTSTANDING progress is being made in the field of machine tools which remove metal in one form or another. For instance, our Company received two automatic lathes which replaced eight machines of a previous design. Another machine has 13 stations and is of the in-line type. This unit performs drilling, chamfering, tapping, rough boring, semi-flush boring and spot facing operations on all sides of the engine block.

Obviously, machines of this type are not duplicated for stand-by operation due to the high initial capital investment, required floor space and other economic factors. Thus, the absolute necessity of keeping the fewer machines operating continuously becomes more important as the latest developments in tooling are placed in practice. Out of this need for safe and uninterrupted operation was born the JIC (Joint Industry Conference) Electrical Standards—a set of regulations originated by equipment users to increase operating safety and reduce maintenance cost.

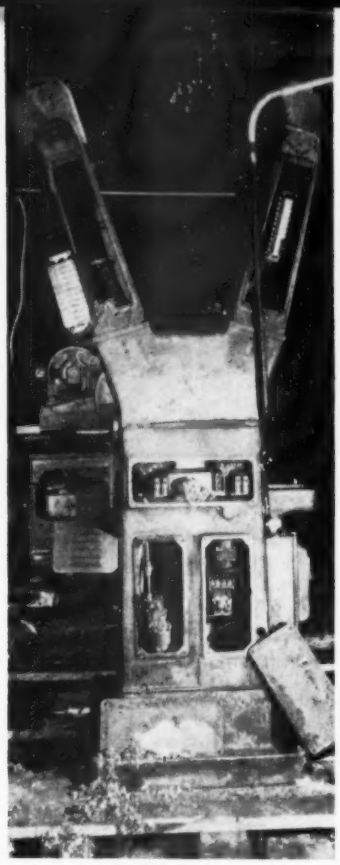
In the early 1940's a first attempt was made to regulate installation of electrical equipment on machine tools. At that time the National Machine Tool Builders Association, in cooperation with the American Standards Association, published an American War Standard entitled "Machine Tool Electrical Standards." However, this standard was not applicable to the wide variety of industrial equipment not generally classified as machine tools (testing and inspection machines, punch presses, welding equipment, integrated conveyor systems, furnaces, paint spraying equipment, etc.). Furthermore, this ASA War Standard did not include many features incorporated in the present JIC Electrical Standard.

About the same time a group of people representing the large mass producing industries, chiefly automotive, met with their equipment suppliers to write a set of electrical specifications which included machine tools and all the aforementioned equipment. It soon became apparent that the safety features and other good practices (accessibility and maintenance ease) were equally applicable to all equipment, be it high or low production.

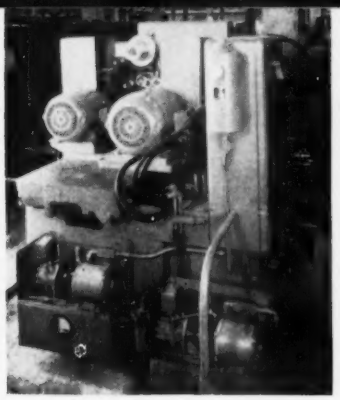


DO NOT USE motor terminal box as a junction box for wires feeding limit switches and solenoids. Down time is lengthened if motor has to be replaced.

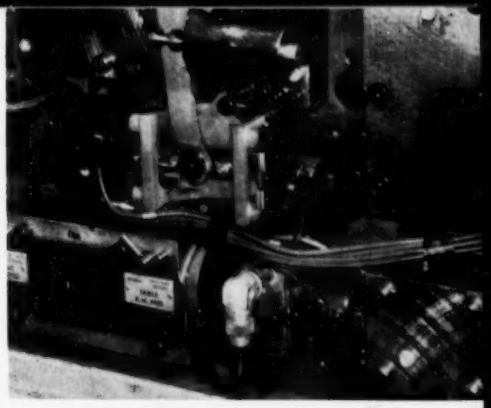
When the rough draft was ready for adoption, an open meeting (Joint Industry Conference) was called. Representatives were invited from National Machine Tool Builders Association, NEMA, Press Builders Association, Furnace Manufacturers,



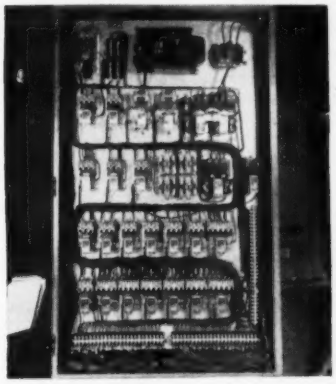
TOO MANY PLACES to check for electrical trouble on this machine. Five "cavities" form tight enclosures for controls; motor has flange-mount. JIC Standards rectify these conditions.



LATE TYPE boring machine has motors readily accessible for servicing. Electrician works in standing position.

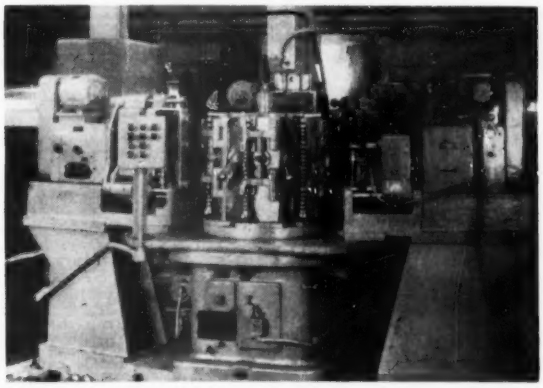


JIC STANDARDS require wires feeding solenoid valves to be enclosed in liquid-tight flexible conduit.

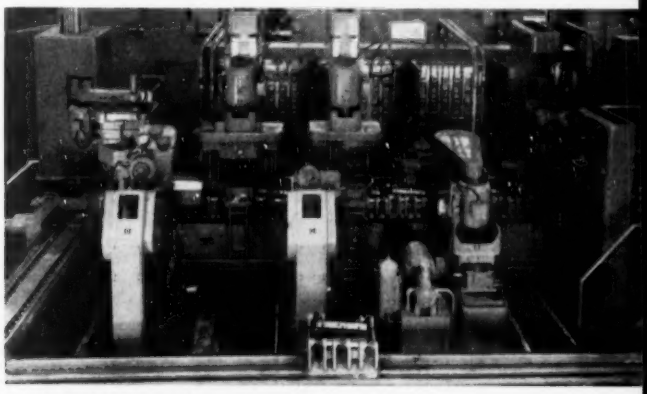


CONTROL PANEL on camshaft drilling machine is in typical NEMA 12 construction enclosure with gasketed door, mechanically interlocked disconnect switch and print pocket.

BUILT-IN FLUORESCENT lighting (not a JIC requirement) in this control panel combines with complete circuit identification (JIC rule) to simplify job of trouble shooting and relay maintenance.



BUILT TO JIC Electrical Standards, this typical drilling machine has accessible motors, operator's control panel of oil-tight pushbuttons in gasketed enclosure, threaded conduit circuits with oil-tight flexible conduit on movable heads.



MAINTENANCE CONSIDERATION was an important factor in design of this in-line type transfer machine built to JIC Standards. Each working head is lettered for cross-reference with wiring diagrams; each index station is similarly identified.

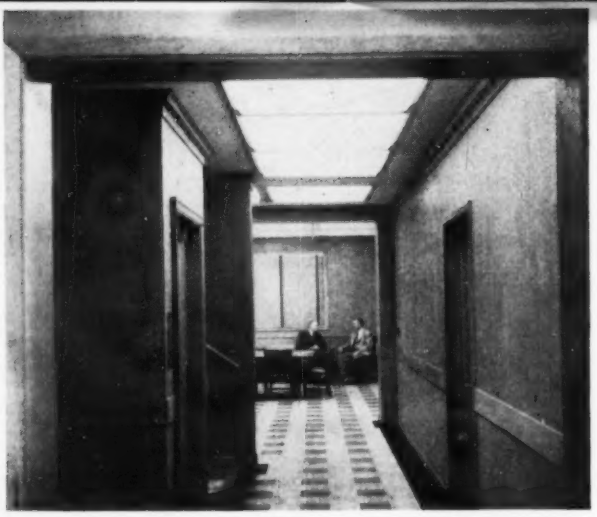
Engineering Societies, and in general, *anyone interested in promoting safer equipment with less downtime.* After many discussions, the first draft was adopted by all parties present at a meeting held in September, 1948. This was the first Joint Industry Conference Electrical Standard. A revision was made January 1950 and future revisions may be expected. Also developed are JIC Hydraulic, Pneumatic, Welding, Transformer, and Press Room Standards.

Having laid the groundwork, the automotive people began specifying on purchase orders that all industrial equipment must conform to JIC Standards. Almost immediately results of the effort began to appear. To those who install and maintain this type of equipment, the results of the Standards will be apparent in the accompanying photographs. Note how the installation of electrical components, when following the Standards, feature accessibility, safety and maintenance ease.

Another problem on which representatives of large equipment users are

(*Continued on page* 194)

A Executive office lighting is adjustable to three lighting levels. Thew Treas. H. L. Reynolds, right, discussing new system with Ted Wakefield, Wakefield Brass Co.

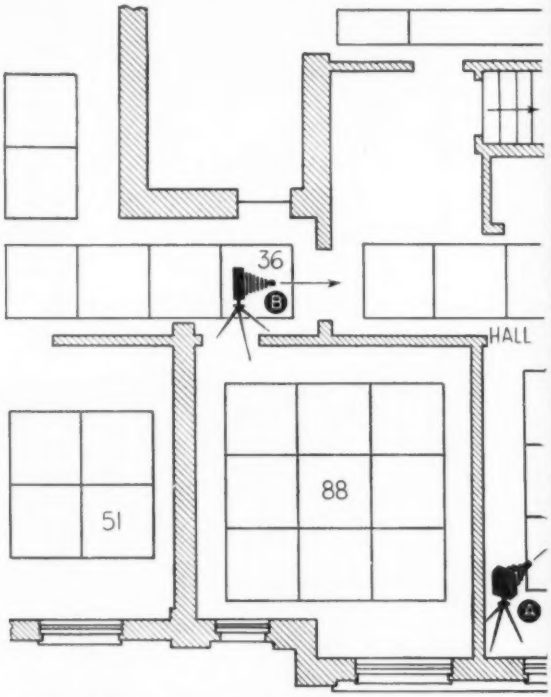


B Corridor treatment uses continuous row of 4 foot panels without acoustic barriers. Another narrower corridor has half size, 2 x 4 foot, panels.

New 4x4 PLASTIC PANELS Light Executive Offices

Luminous ceilings of large plastic panels framed with noise absorbing baffles installed by Ryan Electric Co. at Thew Shovel Co. executive offices in Lorain, Ohio, in the first commercial installation of a new Wakefield design.

By W. T. Stuart



PART PLAN of lobby and offices; numbers show typical footcandle readings. Letters beside cameras are keys to the photos indicating the directions

THE ENTRY, main lobby, corridors and ten offices of the executive headquarters of the Thew Shovel Co., Lorain, Ohio is lighted with the first large scale commercial installation of a radically new luminous ceiling development designed and manufactured by the F. W. Wakefield Brass Co. The installation by the Ryan Electric Co. of Lorain was made under the direction of William Garret, plant engineer of Thew and Smith Associates, architects.

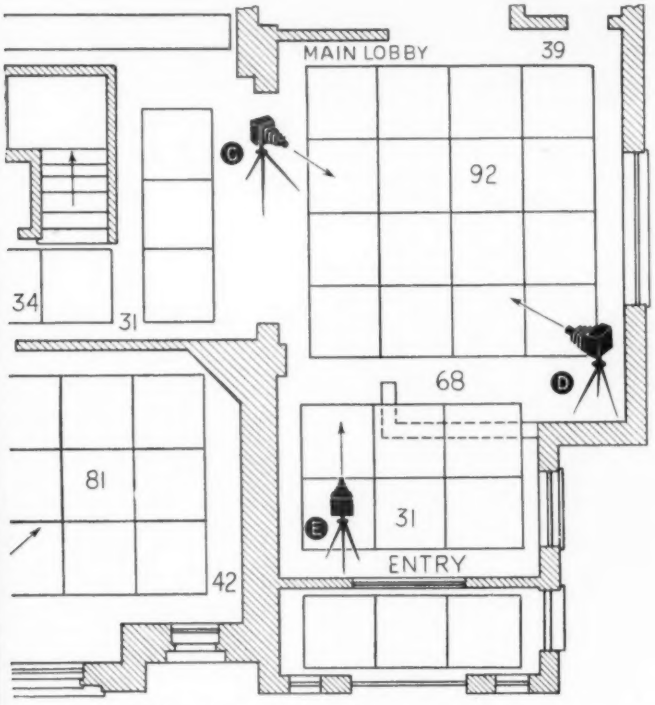
The lighting system consists of geometric patterns of luminous plastic, rigid-arch diffusers in hinged aluminum frames, 4x4 feet, suspended below a grid of fluorescent lamps. The lighting with appropriate light tone colors and finishes in the surrounds provides relatively high (50 to 90) footcandle levels with exceptionally low brightness ratios. Minimizing the brightness of the luminaires is accomplished by separation (12 inches) of the lamps from the diffusing panels, the large area of the diffusers and in inherent diffusing quality of the Plexiglas panels.

The lighting system is a completely integrated suspended ceiling. The lamp channels are fastened to the structural ceiling. Lamps are perpendicular to the wiring channels forming a ladder arrangement with three 48 inch T12 fluorescent lamps above each 4 x 4 foot panel.

From the electrical channels a second channel system is suspended,

C Entry has geometric panel arrangement without acoustic baffles. Acoustic tile extends luminous ceiling to conform to room dimensions.

D Light oak walls, light tones in floor tile and furniture contribute to uniform light density and reduce brightness contrasts throughout the main lobby.



from which the photos were taken. The area includes reception and private offices for Thew Shovel Co. executives.

E Sound absorbing wedges outline panels and reduce noise in ultra modern reception area.

forming a frame to receive the luminous Plexiglas diffuser panels and perforated wedge shaped baffles, filled with Fiberglas, for noise reduction in the area. The structural ceiling and wall area within the 18-inch deep plenum formed by the assembly are painted white for high reflectance.

The plastic panels are domed in the center of each four-foot block to provide great structural strength. Light transmission is approximately 60%.

Access to the plenum chamber above the panels is provided by touch-latches which lock the aluminum frames into a rigid grid. When a touch rod engages the latch the panel swings down. Panels are easily removed from the frames without tools.

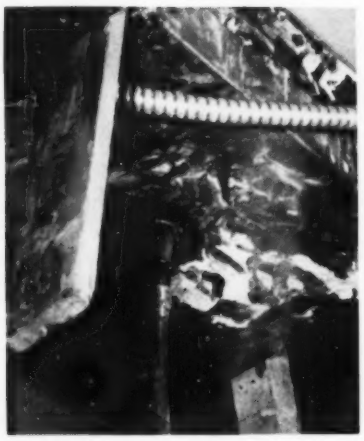
Where required, narrow strips of acoustical tile are installed around the perimeter of the all-luminous ceiling to conform to room dimensions.

Switch control in the executive offices is provided by three single pole switches in a 1 gang plate. Each switch controls one lamp in all panels, thus providing a choice of three levels of lighting intensity. Due to their diffusing quality, the panels appear uniformly illuminated at all three levels of control.

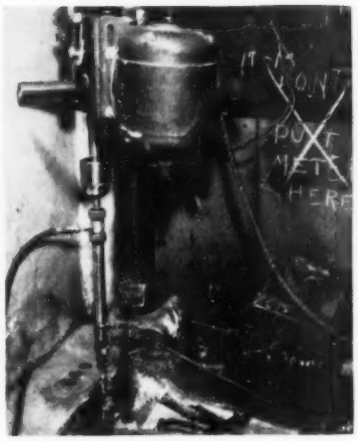
The complete installation consists of 104 square 4 x 4 foot panels and six rectangular 2 x 4 panels (applied to one of the two office corridors) using a total of 324 T-12 48-inch slimline standard warm white lamps on series type ballasts.

Diamond drills speed BUS DUCT

OUTLINE OF DUCT opening is marked on service closet floor. Note cramped working quarters. A putty dam put around opening retained water coolant.



DRAIN PAN FOR water coolant is wedged against ceiling of service closet below opening. Hose connection leads to a waste receptacle on floor.



DRILL PRESS WITH diamond core bits is used to cut series of holes around duct opening outline. Swivel attachment carries water to diamond cutting edge.

WHEN Hall Engineering Company, Detroit electrical contractor, was awarded the contract to convert the electrical system of the 40-year-old Dime Bank Building from direct to alternating current operation, a tough installation problem was presented. Arteries of the new electrical system were 2,000-ampere, 3-phase, 4-wire, low-reactance bus duct risers going from the basement switchboard to the top of the 22-story building.

Structural conditions complicated the problem. As in most old buildings, little space was available to install feeders of this size. The most practical location for uninterrupted, straight, vertical runs was the service closet in a corner at each floor. This meant cramped quarters for workmen to cut a total of 45 rectangular 8-in. by 12-in. openings in the 20-inch concrete floor slabs. As work progressed, an additional complication arose. Due to an apparently poor mix, the aggregate would crumble, roll and break beneath drill bits, giving poor cutting resistance. Drills had to be withdrawn and cleaned frequently. And to top it off, a minimum noise level had to be maintained so that building tenants would not be disturbed too much by the cutting operations.

After early field experimentation with various cutting methods, which proved either noisy, time-consuming, expensive or just unsuccessful, Hall engineers tried diamond drills with the new Truco Water Swivel. This is an attachment for portable or stationary electric drills which supplies coolant water to the cutting edge of the diamond bit.

Hall mechanics used a standard drill press with a V-belt drive and weighted base instead of a portable electric drill. This reduced the noise level about 50% and made it easier on the mechanic. The press was moved from floor to floor on a dolly. An operating sequence, illustrated in the accompanying photos, was established to make each opening. Basically, it involved drilling a total of 26 one-inch diameter holes through the 20-inch slab to outline each rectangle. The center core was then chiseled out with an electric hammer and the opening completed.

The following technique proved to be the most efficient pattern to follow.

The first step involved marking the 8-in. by 12-in. rectangle on the closet floor and building a putty dam around the outline to prevent spreading of the water coolant. A drain pan was mounted to the underside of the floor

CUTTING STATISTICS

For Each Opening in the 20-inch Slabs

Set-up time . . . . . (includes moving equipment from floor to floor)	2.0 hours
*Actual drilling per opening (26 holes) . . . . (per hole — 5.5 minutes)	2.4 hours
Knocking out center core after drilling, including completion of duct opening	3.0 hours
Total time per duct opening	**7.4 hours** (approximately)

Note: *Exceptionally tough conditions on a number of openings resulted in this average time. Otherwise the time would have been about 1.3 hours per opening, or around 3 minutes per hole. Total time per opening would then have approximated 6.5 hours.

RISER INSTALLATION

. . . in a Detroit bank building rewiring project. Hall Engineering Co. used water-swivel drill attachment to save an estimated 40% on slab cutting time

DRILLING IS COMPLETED and 26 holes outline edge of duct opening in the 20-inch floor slab. Coolant water passes through holes to drain pan below.

FINISHED DUCT OPENING with center core cut out of 20-inch floor slab. Note similar opening on floor below. Free-way for two risers required 45 openings.

slab to catch the water after the first hole was drilled and carry the coolant through a hose connection to a drain receptacle on the floor below.

Because of the type of aggregate found in the slab, a three-step drilling procedure was necessary. First, a hole was "indented" with a standard 3½-inch long diamond core bit. Then a 10-inch long bit was used to drill to one-half depth. Finally, a 20-inch long bit was used to complete the hole.

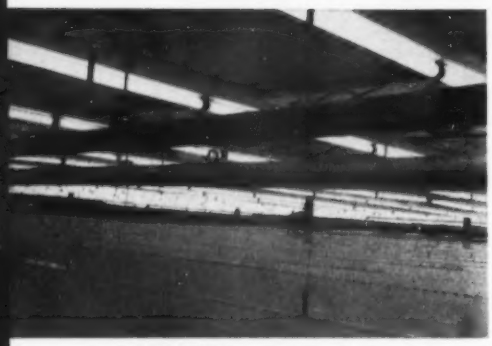
After the first hole was completed for drainage, this three-step procedure was followed for each hole. That is, the remaining 25 holes were all "indented"; then drilled half-depth; then finished with the 20-inch bit. The swinging arm of the drill press permitted drilling several holes in each step before moving the stand for another group. After all 26 holes were drilled, the opening was completed by chiseling out the center rectangular core. Experience showed that two bits (a 10-in. and 20-in.) were "expended" on each *opening*. These were reconditioned with new diamond cutting edges and reused.

Had the slab consisted of a firm and uniform aggregate, the 10-inch bit operation could have been eliminated and the 20-in. unit used to drill the complete hole (following original indentation). Had the quarters been less cramped, the 20-in. bit (with alignment guide) could have done the job in a one-step operation.

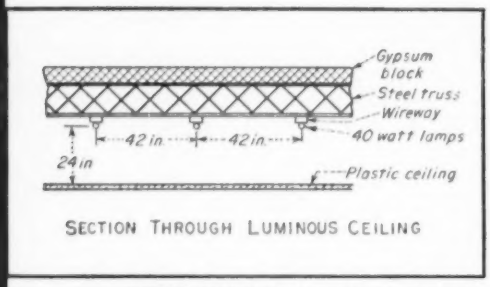
WATER SWIVEL attachment and typical diamond core bits used on drill press. Swivel shank fits standard ½-inch drill chuck. Hose has adapter for standard hose attachment.

Actual drilling time for the 26 holes required for each opening totaled about 2.4 hours—or 5.5 minutes per hole (compared to an estimated 1½-minutes per 20 inches of penetration under ideal conditions). Moving and setting up drilling equipment averaged two hours per opening. About three hours per opening were required to break out the center concrete core and finish the job. Total time spent per duct opening thus totaled about 7.4 hours, or about two openings per day with a two-man crew.

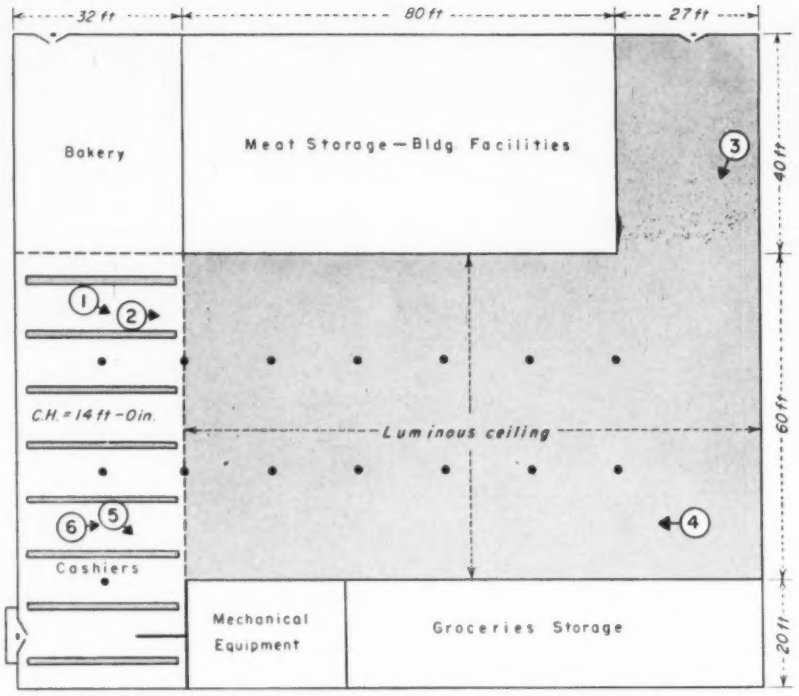
Hall engineers originally estimated it would take two and one-half months to make the 45 duct openings in the Bank's 20-inch thick floor slabs. Actually they were completed in one and one-half months, including field experimentation time with other cutting methods. Although they cost appreciably more than conventional drilling bits, Robert L. Parrish, engineer for Hall Engineering Co., found that the speed and cutting efficiency of the diamond bits proved more economical in the long run. Although overall slab-cutting costs were about the same, he was particularly satisfied that the methods employed cut about one month off the completion schedule of the rewiring project. This is an especially important factor when working in existing buildings during tenant occupancy.



T-TRACKS supporting plastic sections are suspended from wiring strips by wire.



ENTIRE PLENUM above the vinyl plastic ceiling is painted white.



CIRCLES WITH ARROWS in floor plan indicate position of camera for pictures used on right hand page.

LUMINOUS CEILING Lights Modern Super Market

New Food Center Super Market store in Poughkeepsie, N. Y., uses wall-to-wall luminous ceiling to provide uniform 50 footcandle intensity throughout. Electrical contractor John P. O'Shea, Poughkeepsie, made the installation.

By Berlon C. Cooper

A LUMINOUS ceiling lighting system has been installed in the entire merchandising area of the new Food Center Super Market store in Poughkeepsie, New York. Involving 7500 square feet of ceiling area, this installation is believed to be the first major installation in a supermarket, and is among the first of this size and scope for any type of occupancy.

The one story structure housing this new store is 139 feet long by 120 feet wide, totaling 16,680 square feet. The luminous ceiling extends wall-to-wall down the center of the store, covering a 60-foot width over a 107-foot length, and extends out in an L-shape at the rear of the store over an area 27 feet wide by 40 feet long. A section at the front of the store 80 feet long by 32 feet deep is reserved for cashier counters and customer baskets. This section has a 14-foot high ceiling and is lighted by eight 28-foot continuous rows of 4/40-watt fluorescent lamp luminaires, surface mounted on the ceiling. Adjoining areas are used for a retail bakery, employee facilities meat and grocery storage, refrigeration machinery and mechanical equipment.

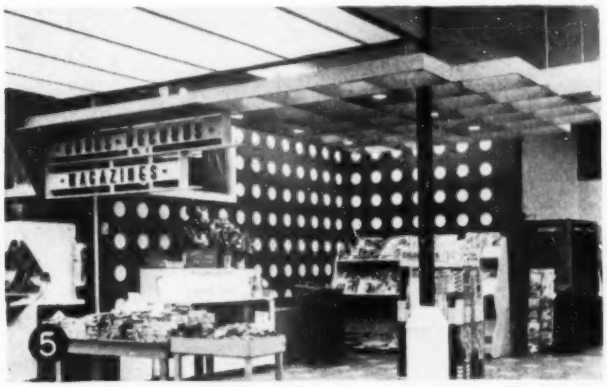
The luminous ceiling consists of corrugated vinyl plastic sections suspended 24 inches below the fluorescent lamps, supported in T-tracks. These sections are 36 inches wide, by 18 feet long, and extend across bay widths. Similar sections are run parallel with bays along the columns, accenting the

MERCHANDISING AREA in the Food Center Super Market's new store, Poughkeepsie, N. Y. is lighted throughout to 50 footcandles average by luminous ceiling, wall to wall.

REFRIGERATED CASES for fish, fowl and meats are highlighted by R-40 300 watt lamps recessed in the luminous ceiling. Warm tone finishes on wall improve the color tone.

SELF-SERVICE COUNTERS at rear of store are flooded with diffuse light from the broad expanse of luminous ceiling, providing strong light in vertical plane.

FRUIT AND VEGETABLE case (left) is self-lighted by two continuous rows of fluorescent lamps. Cashier's counters and front store entrance are at rear of picture.



COLORFUL CORNER of store for magazines, books, records, cigarettes, etc. is opposite main front entrance. Wall treatment is yellow circles on green background.

AISLE for fruit and vegetables is flanked on right by three different colors on wall, plus a fourth color at rear of store, all accented against the white luminous ceiling.

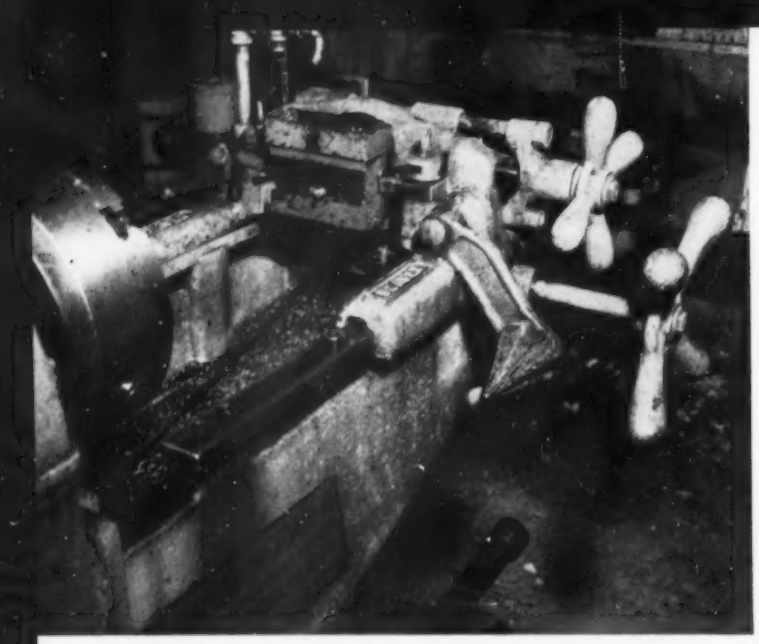
length of the store. The plastic panels are cut out for the columns, and for louvered hot-air outlets.

The fluorescent lamps are installed in continuous rows on wireways attached to the bottom of steel trusses. These rows are spaced 42 inches apart, and the lamps are operated from two-lamp ballasts. A total of 540 standard cool white 40-watt lamps are used. The total wattage is 25,650 watts, or 3.42 watts per square foot. The lighting intensity, measured after 200 hours of burning, averaged 50 footcandles, or 14.6 footcandles per watt per square foot.

Individual display cases are self-illuminated, providing approximately 100 footcandles in the fruit and vegetable cases, and 90 footcandles in the meat cases. Refrigerated open top cases for fish, fowl and meats are also lighted by recessed incandescent reflector lamps, to add reddish-yellow light for improved appearance.

Special attention was given to color of walls throughout the merchandising area. For example, warm tone colors (salmon pink, soft tan, etc.) are used on the wall behind the meat counter, and cool colors (dull green, etc.) behind the vegetable and fruit counters.

The luminous ceiling and all related lighting equipment was supplied by Luminous Ceilings, Inc., of Chicago, who also furnished the lighting layout. The entire ceiling was sold and installed by John P. O'Shea, electrical contractor of Poughkeepsie, N. Y.



BLOCK-DIE JIG is substituted for conventional ring-type diehead on threading machine when cutting short conduit nipples. Jig (J) holds square die (D). Cutting oil from reservoir (R) at top of jig flows onto threads through a ¼-inch hole drilled in each side of die.

DRILL STAND made of channel iron and pipe converts standard electric drill to drill press; can take rough wear and tear of construction work, as it is practically indestructible.

Field Shop Ideas

. . . save time and money for Westphal & Company on their electrical construction projects.

BLACKSMITH'S FORGE with electric blower gets approval of Manager Clarence Brown (left) and Superintendent C. L. Carroll. Bolt rod is being pre-heated for bending. Note nipple bin at right rear.

PROBABLY one of the best ways to come out ahead on an electrical construction project is to have enough power tools on the job. Man-hours is that flexible item of job management which can sink or save a contractor. That is the opinion of Manager Clarence Brown and Superintendent C. L. Carroll of Westphal & Company, electrical contractors of Janesville, Wisconsin.

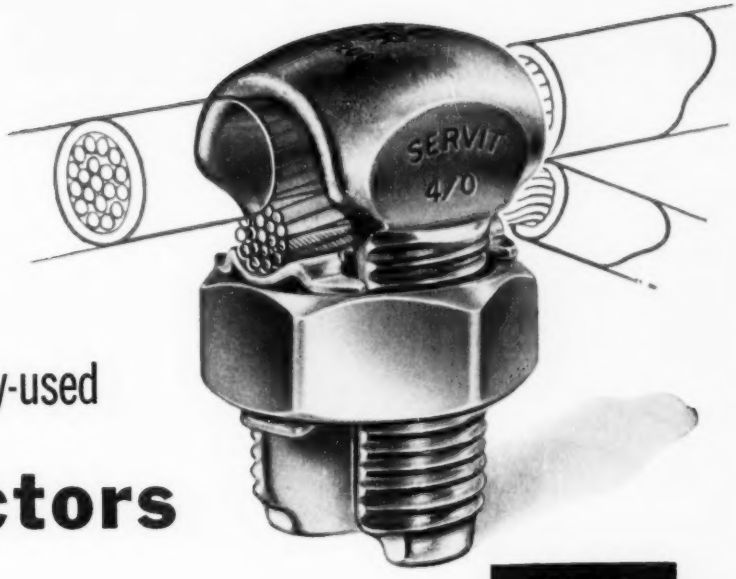
On a recent project, Brown saw the opportunity to do a substantial amount of prefabrication of brackets, supports and similar items in the field shop at the job site. So he and Carroll got into a huddle and equipped the shop with numerous power units: power saws, benders, power threaders, drill stands, welders (electric and acetylene) and even a blacksmith's forge. The net result more than compensated for their previous optimism. When standard equipment did not come up to expectations, Carroll improvised with commendable success.

Among the ideas developed in the field and illustrated here was a jig to hold the block-type square die in the threading machine. For making nipples from scrap conduit, he found that the block die cut closer nipples with a more accurate thread. Normally a ring-type diehead with four die segments is used for conduit threading.

An electric blower was added to the forge so the shop man could heat bolt rod while doing other chores. A hand bender transformed the heated rod into J- and U-bolt hangers.

To lick the breakage bugaboo, shop men built a drill stand from channel iron to convert the standard electric drill into a drill press.

Both men feel that every job presents a challenge to use a higher degree of mechanization. And they try to capitalize on each opportunity.



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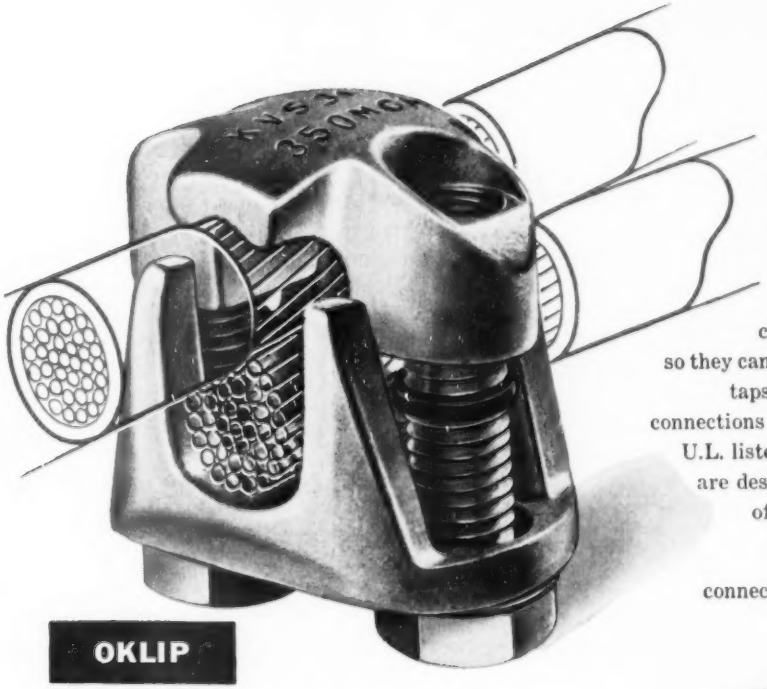

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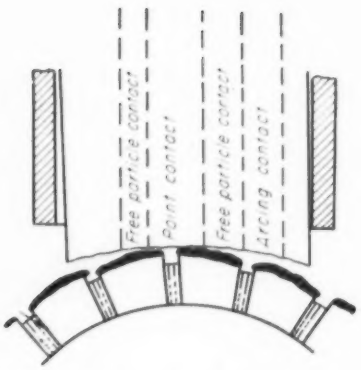


FIG. 1. Brush contact with commutator surface is divided into three parts.

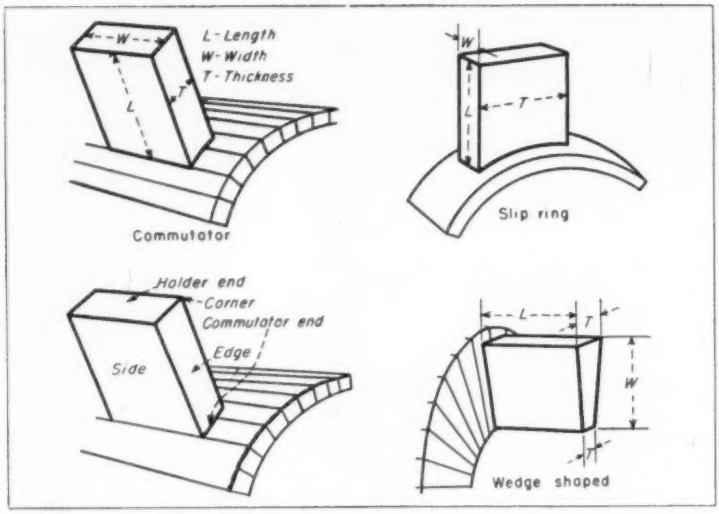
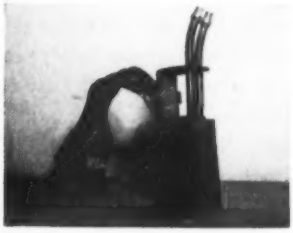


FIG. 2. Dimensions and surfaces of brushes are designated by a standard terminology to simplify and standardize specifications.

CARBON BRUSHES

About electric carbon brushes used in rotating electrical machinery, covering—



- ★ Performance characteristics
- ★ Construction and composition
- ★ Specifications
- ★ Maintenance

By Walter J. Prise,
Chief Engineer,
The Maintenance Company,
New York, New York

A SOUND working knowledge of electric carbon brushes depends upon analysis of their performance, construction, specifications and maintenance. Taken together, these factors tell a complete and detailed story about carbon brushes. Although too often neglected and unappreciated, carbon brushes are vital links in the chain of components which make up rotating electrical machinery. Only from a well-rounded understanding of their proper function and care, can they be accorded the attention they deserve.

Performance

Simply stated, the function of carbon brushes is to conduct electric current between moving and stationary parts of electrical equipment. In this capacity, brushes are subjected to many phenomena which make their task both difficult and critical. They must resist the destructive action of many mechanical and electrical forces while maintaining perfect contact with commutators rotating at speeds as high as 70 mph. Upon the ability of brushes to do their job properly often depends the efficiency and life of many motors and generators which are highly sensitive to the characteristics of brush operation.

In general, good performance of a brush is characterized by the following factors:

1. Absence of damaging sparking.
2. Long brush life and absence of commutator wear.
3. Quiet operation.
4. Small electrical and mechanical losses.

One of the most common problems associated with brush operation is damaging sparking. Sparking may result from any of the following:

Too high a time rate of armature current change during commutation.

Failure to complete a reversal of current.

Over-reversal of current.

Short-circuited pole turn.

Short-circuited or open armature coil.

Poor connection to commutator bars.

Off-central setting.

Commutating pole strength too great.

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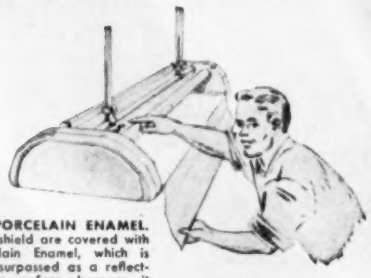

DETACHABLE REFLECTORS are hinged to make possible easier, more thorough cleaning right on the fixture. They may also be detached and cleaned away from the unit. Available with sliding hangers, as shown.

"LIFE-TIME" PORCELAIN ENAMEL. Reflectors and shield are covered with genuine Porcelain Enamel, which is unsurpassed as a reflecting surface because it cannot wear, scratch or become dull.

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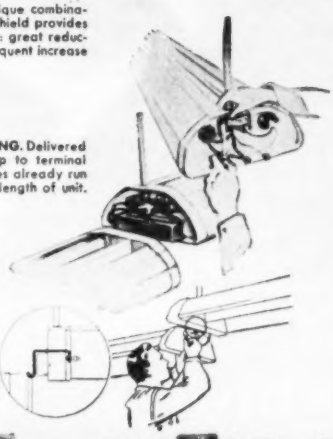
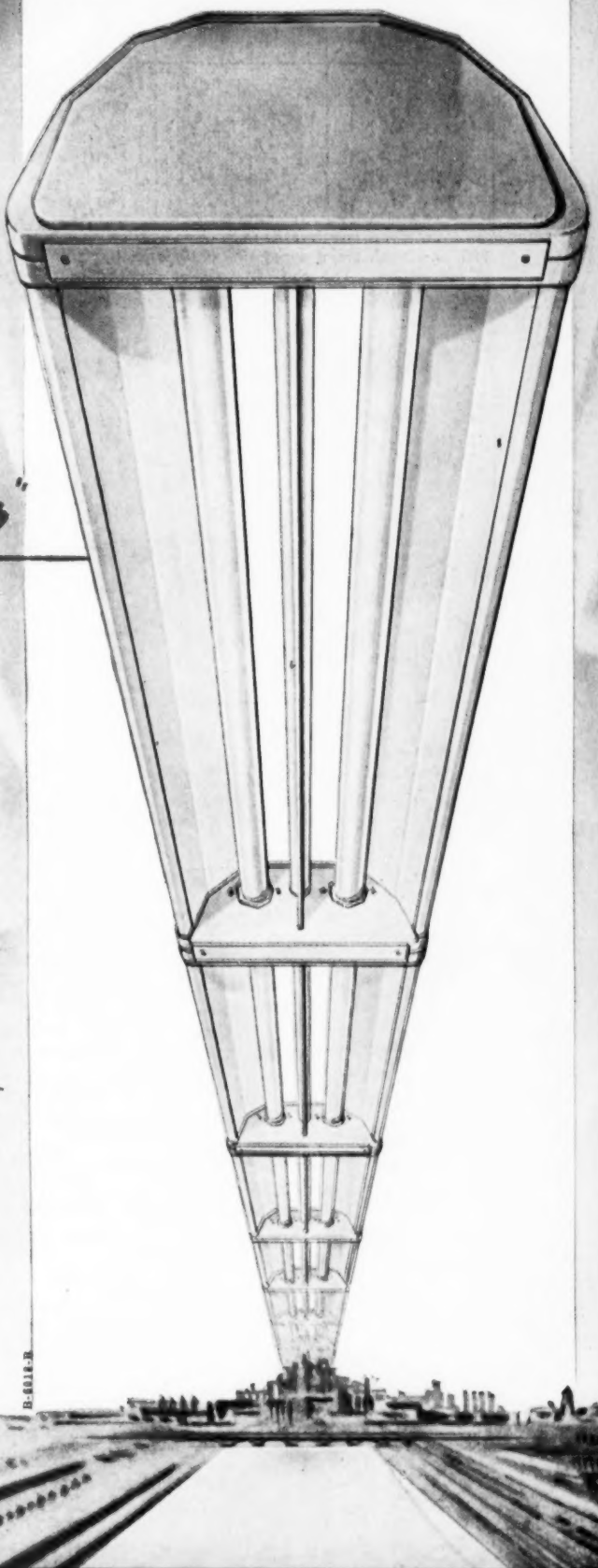


PRE-WIRED—NO WIRE SPLICING. Delivered with all connections made up to terminal block. Branch-circuit wire comes already run through spine support, entire length of unit.

SPECIAL "HOOK-UP" DESIGN makes it possible for the installer to temporarily hang one unit on another while connecting the jumper wires to opposite terminal blocks.



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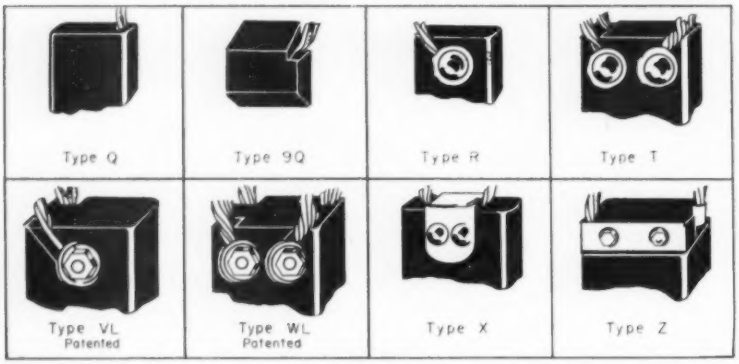

FIG. 3. Brush shunt types are designated by letters according to the method of connection. The general types of connections are shown.

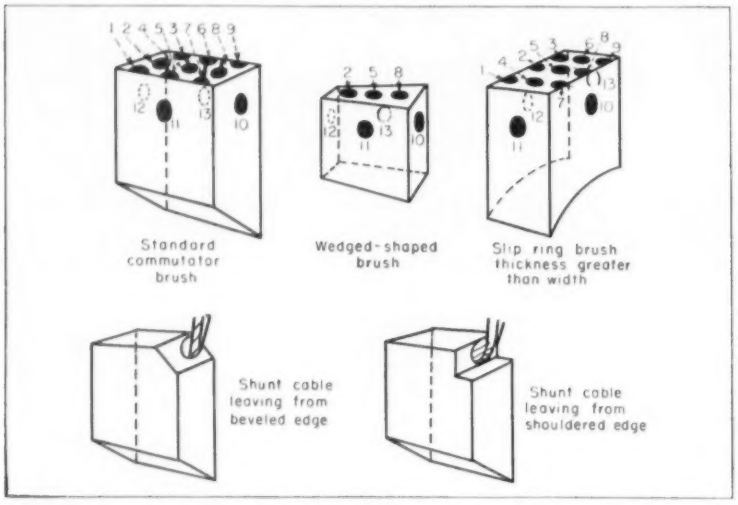

FIG. 4. Location of shunt connection to a brush is notated by a system of numbers, varying for the different brush types as shown.

Unequal distribution of current among several brushes.

Formation of high resistance glaze on the commutator surface.

Rough or eccentric commutator.

Poor and uneven electrical contact.

Excessive peripheral speed.

Vibration.

Chattering of brushes due to dirty film on commutator.

High or loose bar in commutator at high speed.

High mica (not undercut).

In any case of sparking, a check should be made for any of these conditions before the brushes are blamed for poor performance.

The primary requisite for good brush performance is firm, consistent contact with the commutator. Good contact is necessary for efficient and noiseless operation. Of course the nature of brush operation does not permit continuous solid contact, no matter how smooth the surfaces in contact may be. Possible play of a brush in a brush holder, irregularities in curvature of the commutator, mechanical abrasion and effects of local currents divide the contact between brush and commutator into three parts: 1) Points of solid contact, 2) Areas in which free particles of carbon graphite and copper create electrically conducting dust, and 3) Small air gap where current passes in form of an arc. These conditions of contact are illustrated in Fig. 1.

In addition to good contact, brushes must possess sufficient current-carrying capacity to prevent overheating and must have the mechanical ability to remove foreign layers that tend to develop between the brush and the commutator. These properties vary with change in the commutator surface and with atmospheric conditions. Selective action of brushes, which results in burned out shunts and overheating, is a function of brush pressure, condition of the brush contact faces, resistance and shunt temperature.

Important to good contact is the contact resistance between a brush and the commutator. Appreciable contact resistance is necessary to supplement the armature coil impedance in controlling short-circuit current under conditions of imperfect commutation. Contact resistance depends upon the resistivity of brush material, the surface of the commutator or slip ring, the characteristics of brush pressure, humidity and air contamination, the strength and direction of current flow and the grade and dimensions of the brush used. The resistance of the commutator film has a critical effect on proper commutation.

From the foregoing, proper brush pressure is clearly an important factor in brush operation. Brush pressure should generally be maintained at 2 to 2½ pounds per square inch on dc brushes and 2½ to 3 pounds per square inch on ac brushes. On some special motors, good contact may require pressure as high as 4 pounds per square inch. And in all cases, it is highly important that brush pressure be maintained uniform throughout the life of the brush as the length diminishes. Too little pressure is objectionable inasmuch as air between brush face and commutator may create air cushioning; too much pressure, because it produces so-called vacuum-effect by expulsion of the air film.

Brush Wear

Related to contact and pressure is the effect of brush friction which decreases commutation efficiency. Cold brushes and commutators have higher coefficients of friction than warm ones, although friction increases at temperatures above 100 degrees C. Due to friction, brush wear is a combination of mechanical and electrical actions consisting of abrasion, burning and the equivalent of electrolytic action.

Mechanical brush wear is due primarily to abrasive particles which find their way to the active brush faces. Mica flakes imbedded in the brush face tend to wear and disfigure the commutator surface. Vibration causes excessive wear on brushes, pressure fingers and brush holders. Flat on commutator results from such faulty conditions as unequal angular velocity of rotation and loose bearings. A suitable outside film on the surface of the commutator serves to reduce wear and to improve commutation.

Electrical wear is caused by burning and partly by sparking, glowing and electrodeposits. Local current in a short-circuited brush-end may be many times greater than the normal

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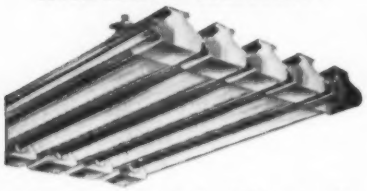

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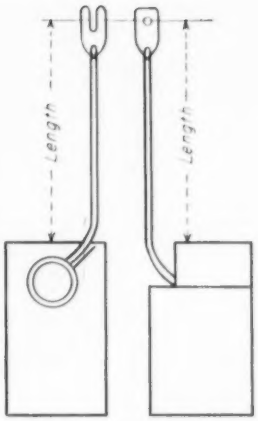

FIG. 5. Length of a shunt is taken as the distance from the holder end of the brush to the center of the connector on the end.

current and may cause glowing beneath the brush face, resulting in pitting of the commutator. Electrodeposition is a transfer of material between brush and commutator according to the direction of current flow. Deposits of carbon on the face of a commutator cause increased friction, poor brush riding and overall poor performance. Transfers of copper to the brush face cause lower contact drop, poor commutation, threading or grooving of the commutator and decreased efficiency.

Construction

Basically, carbon brush material is composed of coke, anthracite, lampblack, graphite, synthetic binders and abrasives. These ingredients are blended in varying proportions and types in manufacturing the many kinds of carbon brushes necessary to meet the wide range of application requirements. Heat treatment is the method by which the mixed ingredients are formed into the brush materials.

In carbon brushes, coke and lampblack are the base materials. Graphite is added to obtain the desired amount of lubrication to reduce friction; it also reduces the resistance of the carbon. Depending upon the proportions of the mixture, various current-carrying capacities per square inch of material are obtained. Another constituent of the final material is a natural ash to act as an abrasive in the finished product. This ash must keep the commutator clean without subjecting it to excessive wear. To bind the ingredients into a solid mass, tar, pitch or one of the newly developed synthetic binders is used.

Various grades of carbon brush materials are derived as a result of the manufacturing process, with a specific application for each brush composition. Carbon-graphite brush material has a current carrying capacity of 30 to 40 amperes per square inch; electrographite has a capacity of 50 amperes per square inch. Electro-graphite is less abrasive than carbon-graphite in action on commutators and slip rings. Resin-bonded graphite brushes have a laminated type construction, with a resistance across the laminate-like structure from 5 to 8 times the resistance parallel to the laminations. Resin-bonded graphite construction effectively reduces undesirable short circuit currents in the face of the brush, making it especially useful in machines with high commutating voltages. Metal-graphite is made by mixing copper and graphite in varying proportions.

No. of Strands	Conduc. per Strand	Diameter of Wires Inch	Circular Mils	Nearest Size B & S	Rated I Capacity
1	33	.002	132	29	3
1	33	.003+	326	25	4
2	33	.003+	652	22	8
7	15	.003+	1,038	20	10
7	9	.005	1,575	18	15
7	15	.005	2,625	16	20
7	24	.005	4,200	14	30
7	37	.005	6,475	12	40
7	59	.005	10,325	10	50
7	75	.005	13,125	9	60
7	95	.005	16,625	8	70
7	119	.005	20,825	7	85
7	150	.005	26,250	6	100

FIG. 6. Table lists the various sizes of cable used for brush shunts. This is an important part of any brush specification.

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ADJUSTABLE BENCH GROWLER

Has adjustable jaws with face length of 2½". With jaws closed will test armatures as small as 1" diameter. With jaws open, will accommodate armatures as large as 18" diameter.

Both types available with or without meters. Also six other models.

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Adjustable arms pull straight without squeezing the work. Set screws prevent spreading. Made in 2 Styles and 4 Sizes up to 24" diameter.

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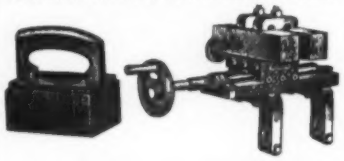

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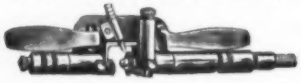

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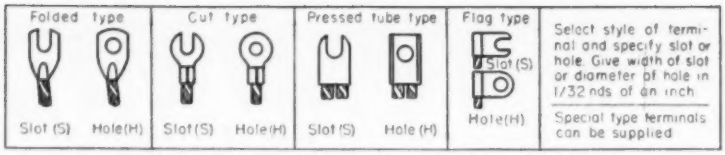

FIG. 7. Standard terminal connectors for shunts are of four distinct types; special types of connectors can be obtained on order.

Specifications

Brush dimensions are given in the following order: length, width and thickness; for round brushes, diameter and length. Length is always taken as the overall dimension in the direction in which the brush feeds the commutator or collector ring. Width is taken at right angle to length and to the direction of the rotation. Thickness is also at right angle to length, but in the direction of rotation. This is shown in Fig. 2.

Most brushes are provided with flexible copper conductor lengths called shunts. Five general types of shunts are in common use: embedded, riveted, bolted, saddle and plate types. Typical shunts, with their letter designations, are shown in Fig. 3. Various types are as follows:

Type M—shunt molded into the brush.

Type P—shunt wedged into a hole in the brush by a screw or pin.

Type Q—shunt secured in hole in the brush.

Type R—shunt secured to brush by a rivet.

Types V and W—shunt bolted to brush.

Type X—shunt connected to saddle which is secured to brush.

Type Z—shunt connected to metal plate which is riveted to brush.

The location of shunt connection to a brush is notated by a system of numbers, as indicated in Fig. 4.

The length of a shunt is the distance from the holder end of the brush to the center of the hole or U slot in the terminal connector on the end of the shunt, Fig. 5. Cable sizes of brush shunts are given in the table in Fig. 6. Shunt terminal connectors are illustrated in Fig. 7; hammers and lifting clips, in Fig. 8.

Maintenance

Proper maintenance of carbon brushes depends upon regular periodic inspection of brushes and commutators. As part of the maintenance procedure, the following should be observed:

1. Replace a brush if the type or size is wrong for a particular machine, or if the brush is worn more than 65% of its normal length.

2. At times of examinations, be sure that the brush, the holder, springs and shunt are clean and that freedom of movement exists between holder and brush.

3. Use sandpaper in seating of a brush, and be sure to replace brushes in their original positions.

4. When necessary, remove free carbon from the commutator with a clean canvas cloth.

5. Order needed brushes in sufficient time to assure their arrival before old brushes are operating in poor condition. Best practice is to order new brushes when brushes in-service are worn to half normal length.

6. Never permit emergency brush repair or replacement to become a permanent installation.

7. Never use brushes made by different manufacturers on one motor. Although each may have satisfactory performance characteristics, a slight difference will usually exist, causing uneven division of current and possible trouble from overheating.

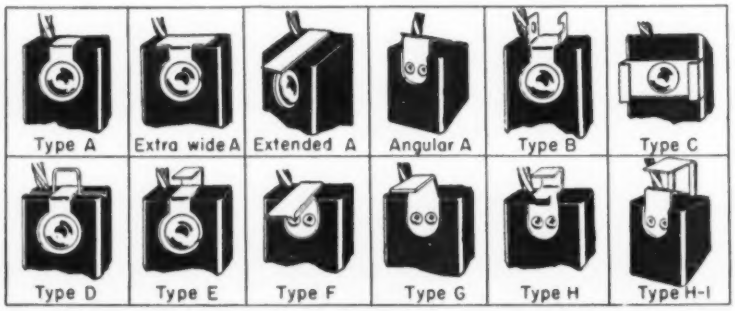

FIG. 8. A wide variety of hammer and lifting clips are designated by type letters and are important to specifications.

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This basic design simplicity accounts for the supreme popularity of Allen-Bradley controls. The A-B trademark is a sales asset on any machine. May we send you our Handy Catalog?

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The Type BXL relay is a standard Bulletin 700 magnetic relay with a mechanical latch. The secondary solenoid, beneath the relay, delatches the upper relay to open it.

Allen-Bradley Co.
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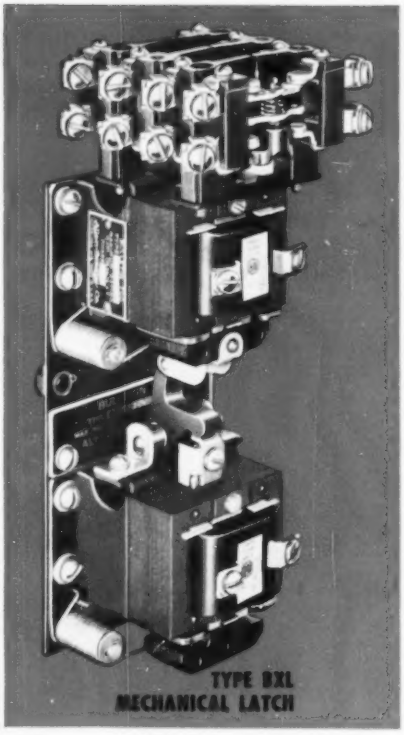
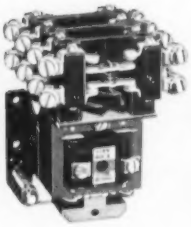


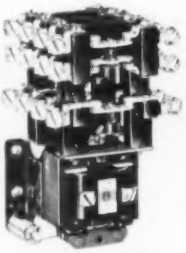
TYPE BXL
MECHANICAL LATCH

A-C and D-C TROUBLE FREE CONTACTORS and RELAYS
for Automatic and Sequence Controls



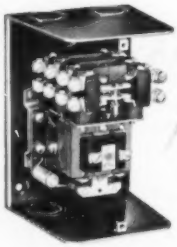
4 Pole A-C Relay

This universal type relay is equipped with four normally open contacts and four normally closed contacts, all actuated by one solenoid plunger. Great flexibility of circuit connections is offered by the double arrangement of contacts. Will handle circuits up to 600 volts a.c. Widely used in refrigeration and air conditioning. Contacts need no maintenance.



8 Pole A-C Relay

Bulletin 700 relays are listed in many contact combinations and polar arrangements. They are widely used for oil burners, stokers, unit heaters, and as control relays for electric furnaces. They are good for millions of trouble free operations. Their consistent performance makes them ideal for machine tool sequence operations. There is no contact maintenance.

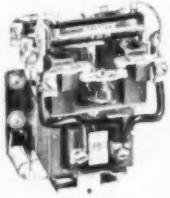


Relay in Enclosure

These relays can be furnished open or in enclosures that protect them in applications where watertight, weatherproof, or explosion-proof enclosures are needed.

Push buttons and limit switches available in a variety of enclosures.

Send for Allen-Bradley Bulletin 700 for details of relays with 1, 2, 3, 4, 5, 6, 8, and 10 poles.



3-Wire Thermostat Relay

Low Current A-C Relay

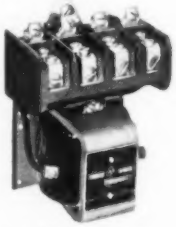
For temperature controls with thermostats.

D-C Relay

2 N.C. —1 N.O. contacts.

A-C Contactor

Allen-Bradley a-c contactors are available up to 900 amperes.



D-C Contactor

Allen-Bradley direct current contactors are available in single and double pole construction up to 600 amperes.

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Motor Shops

Automatic Lathe Control For Layer-Wound Coils

How a standard six-inch lathe was transformed into an automatically controlled winding unit for making layer-wound coils.

A bit of ingenuity on the part of Fred Selby and his mechanics in the motor repair department of Lansing Electric Company, Lansing, Michigan, has transformed a standard six-inch lathe into an automatically controlled winding unit for making layer-wound coils. Result: A reduction of some 75% in the time normally required to wind holding coils, magnetic chucks and similar coils for other electrical devices.

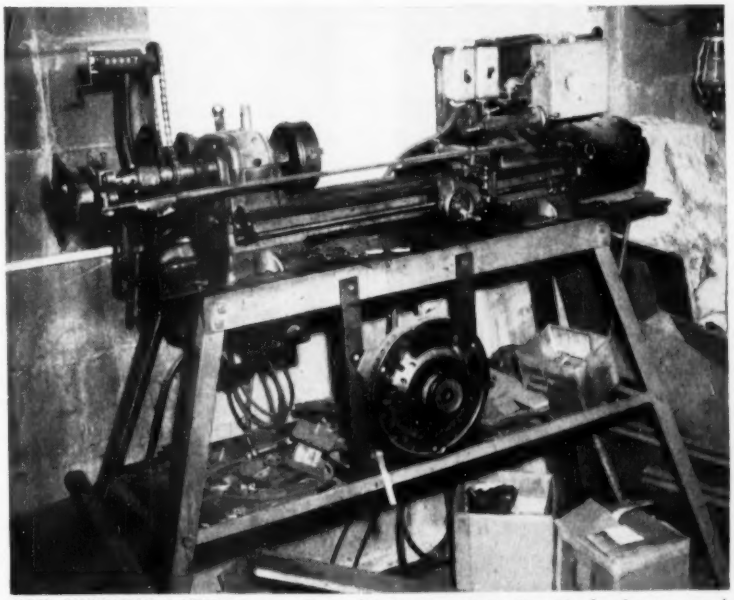
Prime goal in the redesign of the lathe was to develop a machine that would do two things: (1) Automatically guide the magnet wire on the coil form so the turns would lay snugly side-by-side; and (2) automatically reverse direction as each layer of turns was completed. To accomplish this several changes were made.

A standard Jacobs chuck was added to the shaft extension on the gear box at the lathe face plate. This chuck holds the coil forms out beyond the lathe bed. A ¼-hp, single-phase, 110-volt, 1725 rpm, alternating current motor drives this winding head. Four v-belt sheaves of different diameters permit speed variations. A chain-driven counter indicates the number of turns wound on the coils.

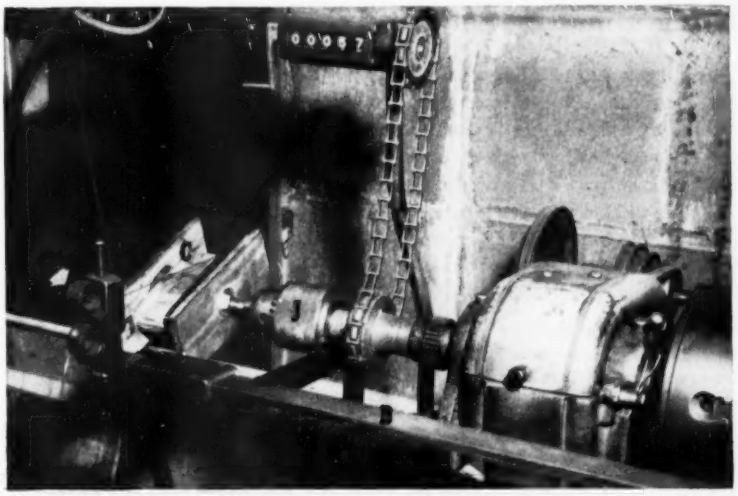
On the opposite end of the lathe, a ¼-hp, 115-volt, 1725 rpm, direct-current motor with associated gear train was added to drive the tool post feed-screw. Automatic reversing of tool post travel is accomplished by a limit-switch and reversing-switch combination. Motor speed, and hence speed of tool-post travel is varied by means of a rheostat mounted to the front of the channel-iron and angle-iron bench on which the lathe is mounted.

Tool-post travel is extended to the coil form beyond the lathe bed by a flat steel bar, one end of which slides in a supporting collar near the Jacobs chuck. The other end is bolted to the tool post, through one of five different holes to permit changing the effective length of the bar for narrow or wide coil forms.

A simple tension device on the end of the sliding bar guides the magnet wire on the coil forms as the bar



COIL WINDING LATHE is transformed into an automatic unit for layer-wound coils by addition of winding-head chuck, extension bar on tool post, and automatically-reversing direct current motor drive on tool post feed-screw. Device cuts winding time about 75%.



WINDING HEAD end of lathe showing tension device (arrow) mounted to tool post extension bar (B). As bar moves from right to left and return, tension device guides magnet wire on rotating coil form (C) held in Jacobs chuck (J). Coil turns nestle snugly side-by-side on each layer; are registered on chain-driven counter above.

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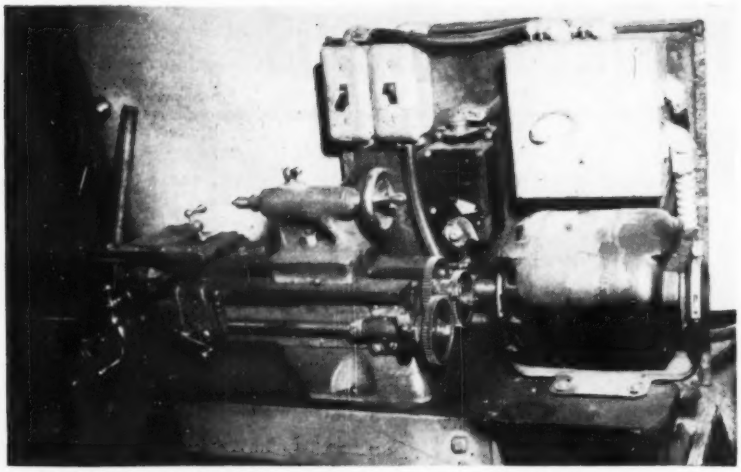

AUTOMATIC REVERSING of tool post is provided by feed-screw gear train and direct current motor with reversing contactors and limit switch arm (arrow) connected to actuating tie-rod. When post brackets hit adjustable stops on arm, switch operates and reverses motor.

moves from left to right and back again. It consists of two fiber "lips" which hold the wire under tension provided by a spring and set-screw arrangement. The tension attachment can also be mounted to the bar extension near the tool post when larger coils are wound on forms held in the lathe face-plate.

Automatic reversing of tool post travel is accomplished by a rod supported at the back of the lathe and attached to the limit switch arm. Sliding "stop" collars equipped with set screws can be set to limit "left" and "right" travel of the post (and its bar extension) according to the width of the coil form being used. Bracket attachments on the tool post saddle strike the stop collars and move the rod sufficiently to actuate the limit switch and reverse the feed-screw motor.

Once the limit switch rod "stops" are set and winding head motor and feed-screw motor speeds set, coil winding becomes automatic. The tension device on the bar extension guides the magnet wire on the rotating coil form so the turns nestle side-by-side. When the left side of the coil form is reached, the bracket on the tool post saddle hits the limit switch bar stop and actuates the switch arm. The direct current motor reverses and the tension device begins to move to the right forming the second layer of turns. When the right side of the coil form is reached, the right hand stop on the limit switch bar is struck by the saddle bracket and the limit switch rod moves to the right, again actuating the switch and reversing the feed-screw motor for the next left-hand pass over the coil. This sequence proceeds automatically until the required number of turns (registered on the counter) are added to the coil form and the unit is turned off manually.

Selby's department uses this automatic winding lathe for coils wound with wire ranging from No. 36 to No. 12 and 14 in size. The mechanics like the unit and find that it has led to a substantial increase in the quantity and quality of coils wound in the Lansing Electric Motors' repair shop.

Gas Oven Speeds Burn-Strip Cycle

"Motor stripping time has been reduced by as much as 60%", claims Charles Buckley of Atlantic City,

PRIOR TO ROASTING, stator is hoisted to rolling tray supported by steel-frame dolly. Dolly is rolled into position on casters, and tray, bearing the stator, is pushed into position to rest on the oven rack.

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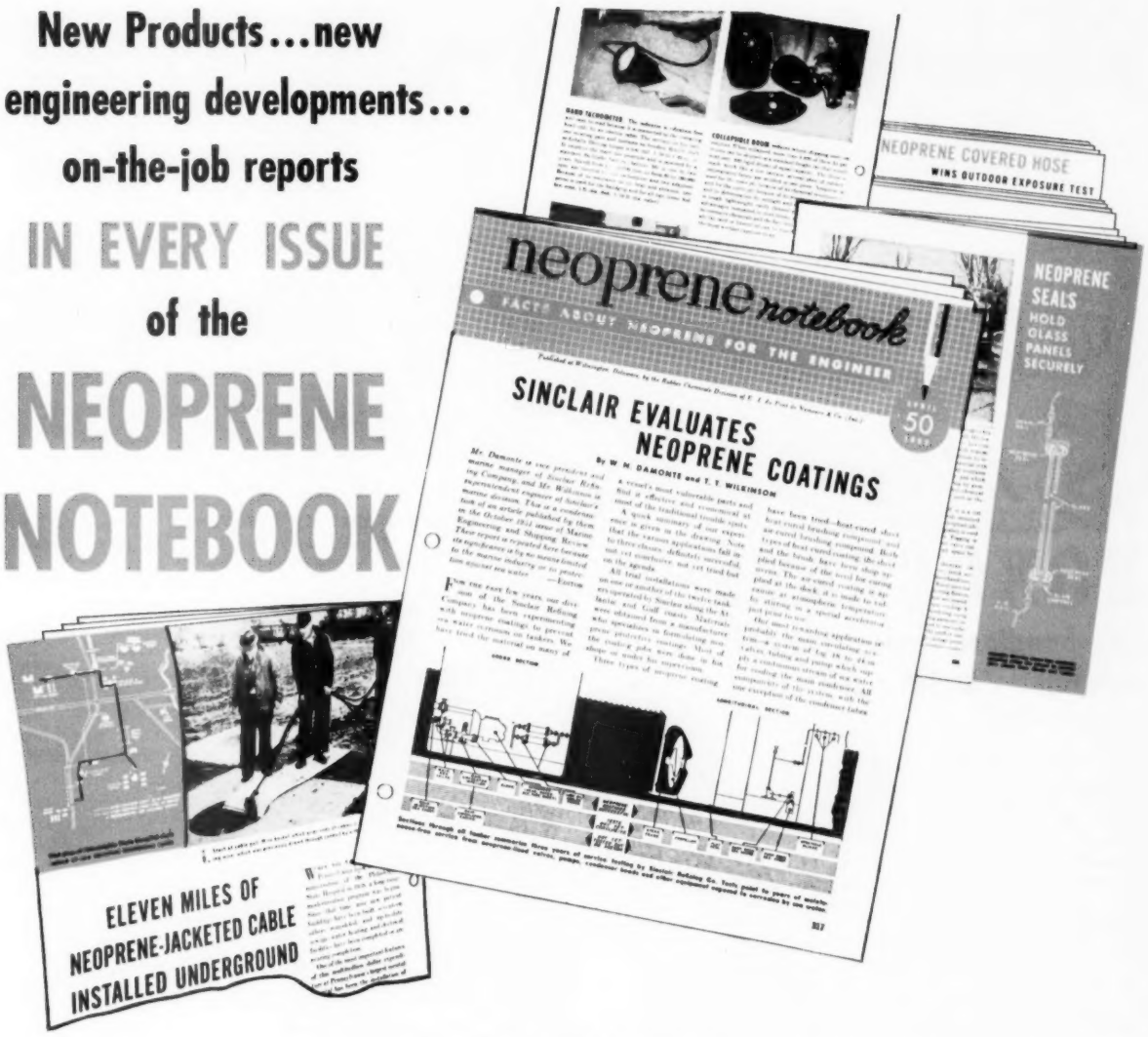
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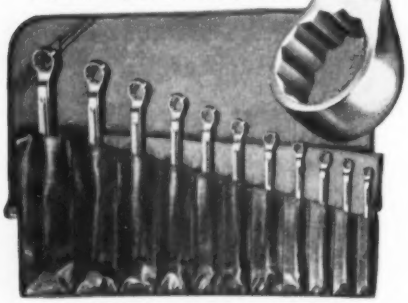

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SIZE OF GAS FLAME is regulated by selection of burner nozzle. Exhaust hood keeps shop fumes at a minimum, reduces shop temperatures, speeds the burn-strip cycle by shortening the stator-cooling period.

N. J., who designed a gas-fired oven for burning insulation from coil slots prior to the pulling operation.

Of simple construction, the oven has 3-by-4-foot sheet metal sides bolted to the concrete-block wall of the shop, and the front section of similar overall dimensions is vertically halved and hinged to form double doors. Different size burner nozzles can be attached to the gas unit, depending upon the size of stator being roasted.

In order to facilitate the shifting of stators in and out of the oven, units are placed on a rolling tray which, in turn, is supported by a caster-mounted dolly constructed from welded angles. Since the top angles of the dolly framework have exterior legs turned upwards, they serve both as guide track for the tray and reinforcing members for the dolly. Height of dolly and height of oven rack are equal so that the tray may be rolled directly from one to the other. Cross members of the tray are so spaced that the flame of the gas burner freely rises between them.

To rid the shop of fumes and excess heat, a fan-served hood surmounts the oven. This hood also speeds the cooling period, resulting in a shortened burn-strip cycle.

Flared Varnish Tank Has Double Purpose

An 18-inch round varnish tank fitted with a 4-foot round funnel has a double purpose in the shop of H. N. Crowder Jr., Allentown, Pa. First,

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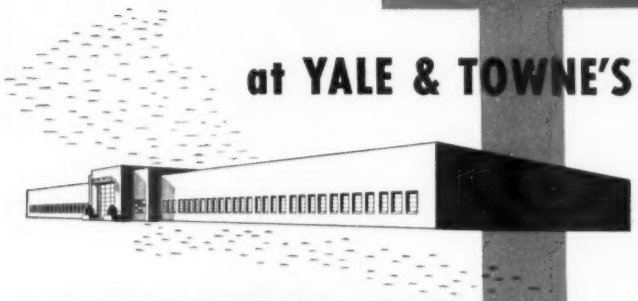
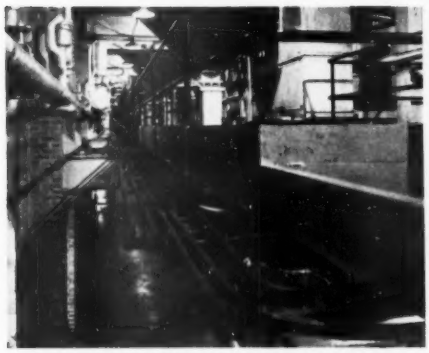
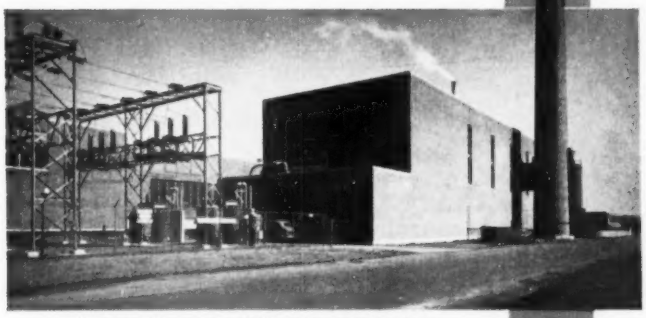




From this 34.5 KV substation, Keystone-Hazaprene 5 KV Cables serve as underground primaries carrying the 2400 volt, 3 phase current to the main switchboard in the boilerhouse.



Keystone-Hazaprene 600 volt control cables operate from the switchboard in this boilerhouse, underground to the 4 substations that supply current to the equipment manufacturing famous Yale and Towne lift trucks and machine tools.

An excellent example of modern design and construction, the new Yale and Towne Plant in Philadelphia is typical of current industrial building... here you'll find Keystone-Hazaprene Cables. Like new plants, cables are an investment, and Keystone-Hazaprene pays off with the premium performance and long, maintenance-free service that means long term economy.

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In planning new plants or circuit expansion, you'll find Hazard's engineering staff helpful in selecting proper wires and cables. Over 50 years of manufacturing and service experience provides a solid background of research-tested, field-proven data covering every type of installation. This assistance is available without obligation. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD Insulated wires and cables for every electrical use

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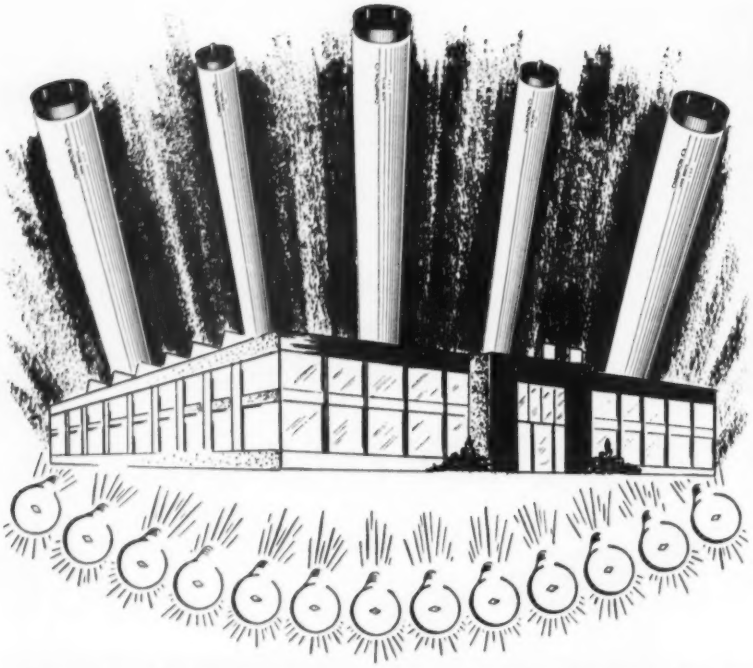

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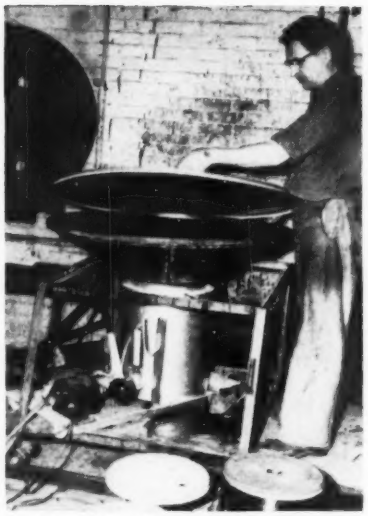

FUNNEL ARRANGEMENT enlarges the effective diameter of this varnish tank, making it possible to suspend large units above the tank and allow excess varnish to return by gravity into the lower chamber.

it prevents an overflow of varnish onto the shop floor when small armatures are submerged into the tank and second, it permits larger assemblies to be suspended above the tank when varnish is poured over the windings. Excess varnish drips to the sloping sides of the funnel and returns to the tank through the natural force of gravity. A lid fitted with two handles is placed over the funnel top when the tank is not in use, thereby preventing debris from contaminating the varnish. The assembly also protects the life of the varnish.

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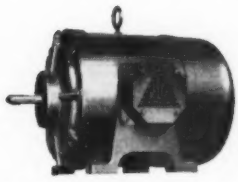

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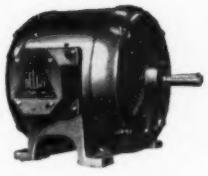

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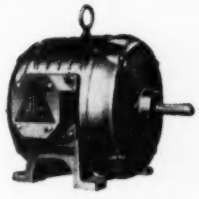

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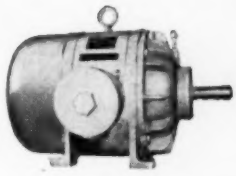

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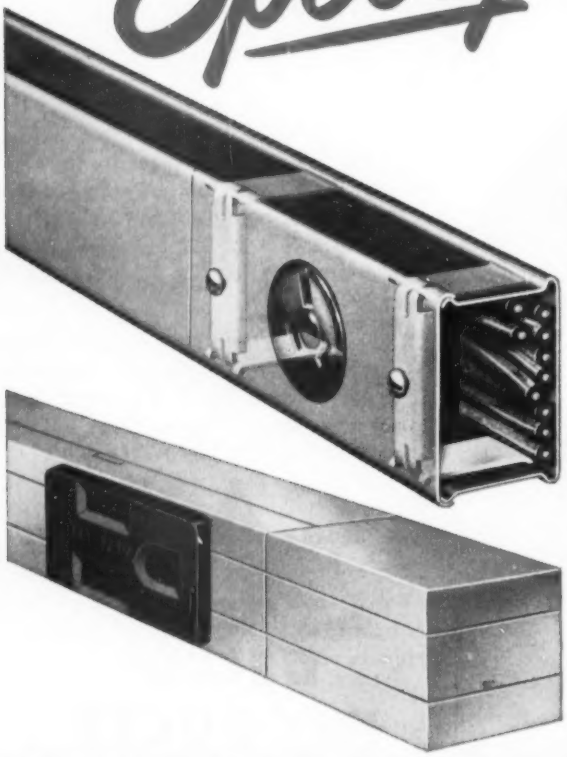

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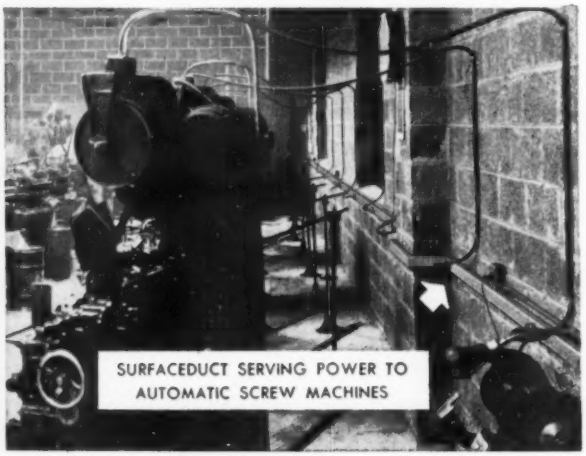

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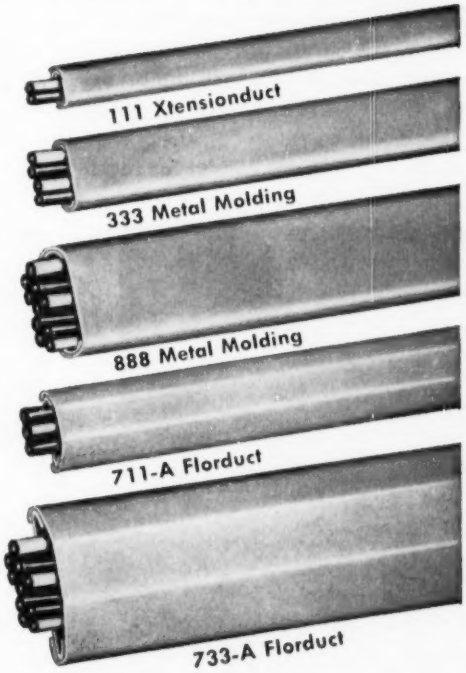

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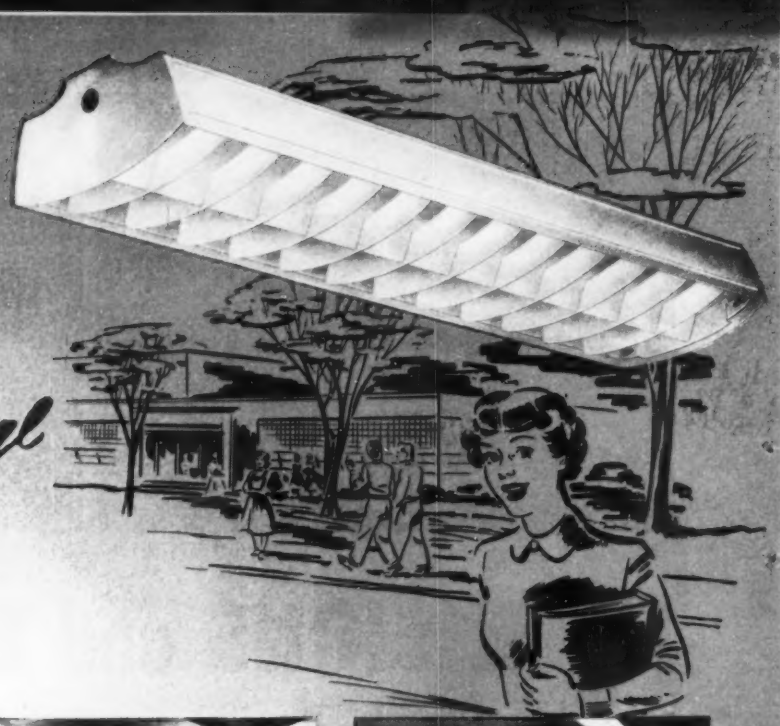
Reavis High School chooses *Leader*



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- **CORRI-LITE — Channel and unusual style baffles of steel. For single Slimline lamp in 48", 72" or 96" length.**

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Modern Lighting

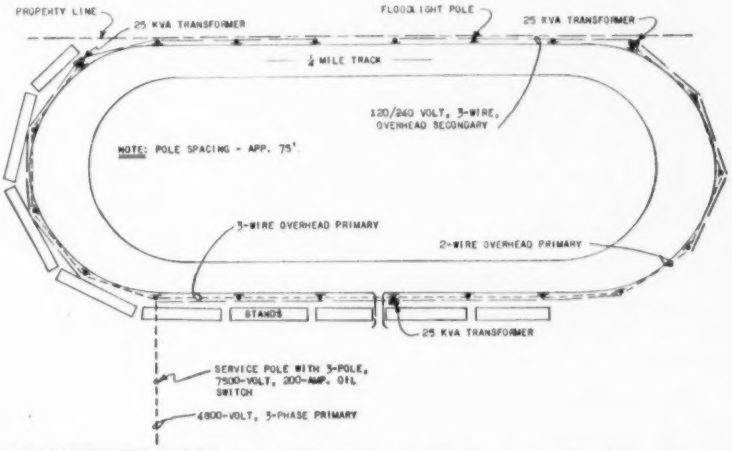
Floodlight Plan for Auto Racing Track

When a quarter-mile track for midget and stockcar racing was planned for Brewerton, New York, the design and installation assignments were referred to R. H. Goodman, applications engineer for Crouse-Hinds, and electrical contractors Bradley & Williams of Syracuse. The objective was to provide an average illumination of 15 footcandles on the track and, proving the accuracy of the designed plan, the obtained average was 15.4-fc. This was quite satisfactory, for it provided good visibility for the 5500 spectators, it doubled the average intensity found on similar rural tracks, and it was accomplished on a limited budget.

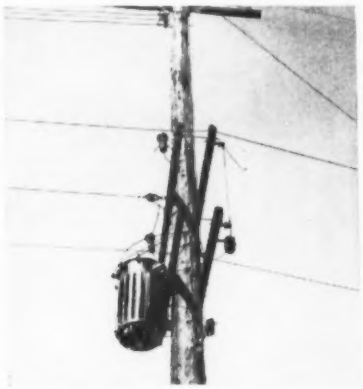
A general purpose type 1500-watt floodlight (CH-MUA Model II) was selected, incorporating an Alzak aluminum reflector, cast aluminum socket housing, mogul screw procelain receptacle, heat-resisting lens, horizontal and vertical adjustment graduations, removable wiring cover, and keyhole slots aronud the reflector base for convenient replacement from the rear or pole side. General PS-52 clear-bulb 115-volt service lamps were used, operated 10% above rated voltage to obtain approximately a third greater lumen output at the expense of a shorter life cycle.

To shorten the required beam throw, it was decided to place the floodlight poles around the track in front of, rather than behind, the stands and, to raise lamps above the normal viewing angle of spectators, a 30-foot

BREWERTON SPEEDWAY, seating 5500 spectators, is illuminated by 63 general service 1500-watt floodlights mounted 3-to-a-pole at a height of 30 feet and spacing interval of 71 feet.



QUARTER-MILE TRACK is circled by 21 floodlight poles, with three 25-kva transformers stepping 4800-volt utility service to 120/240-volt utilization level. Lamps are operated at 10% above rated voltage.



TRANSFORMERS, cutouts, lightning arresters, primary and secondary wiring, crossarms and floodlight units are pole-mounted above the normal vision angle of spectators.

POST HOLES were driven by motorized auger on rear of electrical contractor's truck. Holes were located every 71 feet, thus keeping the spacing less than 2½ times the 30-foot floodlight-mounting height.

New Floodlamps Solve Tough Problems Indoors and Outdoors

MAXIMUM LIGHT OUTPUT • WIDE BEAM

200 to 1000 Watts
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High light output maintained throughout lamp life. Only simple socket required. No reflectors to clean.

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Hard glass withstands moisture and sudden temperature changes. Inside silver reflector not affected by dirt and corrosive fumes.

For Outdoor Lighting

Permits use of low-cost weatherproof housing, reducing cost, size, and weight of installation. Easy to maintain.

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mounting height was selected. By accepted practice, spacing of poles was to be kept with 2½ times the mounting height, or 75 feet apart in this instance. And, since the outer periphery of the track measured 1490 feet, this spacing limitation was satisfied by erecting 21 poles 71 feet apart.

With mounting heights and spacing determined, beam patterns were plotted on typical scaled sections of the track. Three floodlights were mounted on each pole; one unit directed at right angles to the track and the other two, with narrower beam spreads, focussed at varying points further along the racing surface. By directing light in the direction of the races, glare to drivers is minimized and safety is correspondingly increased.

Primary power for the lighting installation is 4800-volt 3-phase, carried through a 3-pole master-control oil switch to three 25-kva pole-mounted transformers. Each transformer, stepping current to 120/240-volts, serves 7 poles, i.e., 21 lamps. Pole holes were dug by a power-driven auger, with crossarms and all equipment installed after the poles were erected and securely guyed.

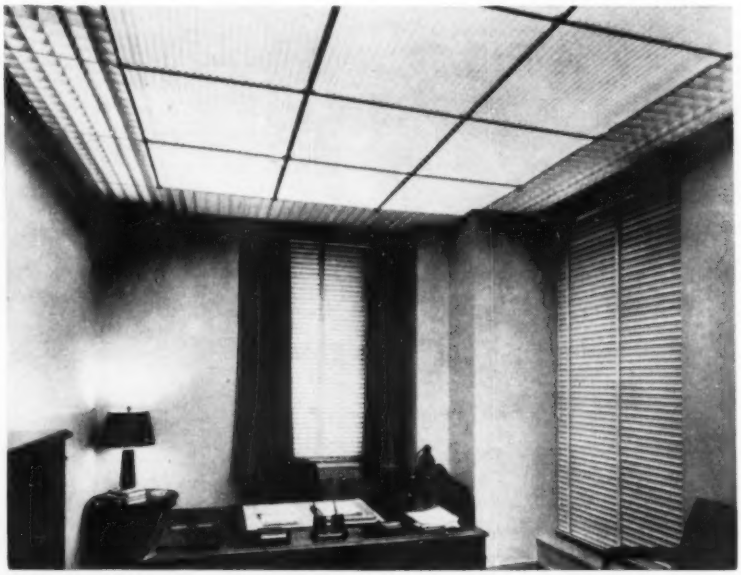
Office Combines Louvers With Translucent Panels

Two types of modular ceiling units are used effectively by Sylvania Electric Products in their new offices in New York City. One is the newly-developed Flexi-module panel constructed of corrugated plastic bounded by a metal retaining frame, and the other is a conventional square cell louvered module. The private offices combine these two panels in a luminous ceiling installation, with Flexi-modules covering the central area and a border of louvered units hugging the walls. The combination avoids reflected glare from the upper wall surfaces and, by permitting a slightly higher intensity of light to strike the vertical surfaces, it reduces the overall brightness ratio in the room.

The illumination on the surface of the desk shown in the photograph below measures approximately 100 footcandles. Warmtone lamps are mounted end to end in rows 15 inches on centers and 12 inches above the plane of the suspended ceiling panels.

Period Chandeliers Used In Modern Setting

Etheridge's Restaurant in suburban Evanston, Illinois, contradicts the assumption that large ornamental luminaires cannot be attractively incorporated into lighting plans for small areas. For there, although the restaurant is barely wide enough to accommodate booths, counters and serviceways, the enjoyment of dining is vastly improved by the tasteful use of color, an acoustical ceiling, air conditioning, modern murals and stylized period chandeliers. These 8-lamp fixtures are essentially for atmosphere, while lighting for seeing is provided by recessed downlights above the booths and shielded fluores-



100 FOOTCANDLES of diffused, even light are delivered to this desk top by fluorescent lamps mounted a foot above the translucent luminous ceiling on 15-inch centers. Conventional louvered panels around the periphery of the ceiling reduce reflected glare and reduce brightness ratios in the room.

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For over 35 years, TRIANGLE CONDUIT & CABLE CO., INC., has provided, through its nation wide network of distributors, the arteries for electrical systems—for industry, business and the home.

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VR300X has a heat resisting screw type front lens (as shown below). The junction box may be hung pendant, or ceiling mounted as an X type fitting. Plugs are provided for the unused ½" IPS Threaded opening.

The VR300X is the ideal floodlight for factories, loading platforms, storage yards, docks or warehouses.

Only $13.00 List

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ATMOSPHERE LIGHTING is provided by 8-lamp ornamental fixtures while functional illumination emanates from ceiling-recessed downlights and fluorescent coves in Etheridge's Restaurant, Evanston, Illinois.

cent strips above the counters and service areas.

The design of the restaurant was created by architect Clifford Nordlie, while A. S. Almryde, illumination engineer for the Public Service Company of Evanston, recommended the lighting plan which was installed by the Main Electrical Company of Chicago.

Combination Lighting Boosts Carpet Sales

The Nazarrian Brothers carpet showroom in Evanston, Illinois, combines general and local lighting through an installation of fluorescent and incandescent fixtures. A recessed oblong of alternate fluorescent and incandescent fixtures utilizes lensed panels for light diffusion and slight direction, while drama-type bullet-shaped floodlight hoods are surface-mounted above featured wall displays. General illumination measures 30 footcandles while highlighted areas double this intensity. The judicious inclusion of broadloom carpeting in the showroom, draperies, color and modern furniture make this sales area a pleasant, intimate business center.

The use of incandescent lighting in this showroom was dictated by the necessity of showing the rich fibre construction and colors, which fluorescent does not bring out.

RECESSED FIXTURES, fluorescent and incandescent, provide 30 footcandles of general lighting while adjustable surface-mounted floodlights double this intensity on carpets being displayed on wall racks.

Three quality tapes—friction, rubber and plastic...

If the job requires taping —it calls for ACCURATE

Make ACCURATE Electrical Tapes your choice for easier taping and positive electrical and mechanical protection. Both friction and rubber, ACCURATE tapes are strong, pliable, easier working. These quality electrical tapes are non-raveling, tear off clean, pull tight and firm ... make neat, high efficiency wraps even over irregular surfaces.

For special jobs where a reduction in bulk is essential, specify ACCURATE plastic electrical tape. Thin caliper, combined with excellent dielectric strength, make it the ideal tape for faster wiring production!

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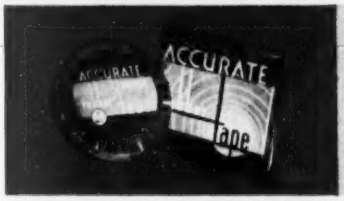
High grade carefully compounded rubber with finest cotton base provides maximum mechanical protection for every wrap. Made in Standard and A.S.T.M.



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Features high elasticity, excellent cohesion, high dielectric and super aging qualities. Available in Standard and A.S.T.M.-A.A.R. grades.

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Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.

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Just call or write for the handy new Accurate catalog. A handy brochure for electricians, maintenance engineers and purchasing agents which includes all the facts on electrical tapes. Address: Accurate Mfg. Company, Garfield, New Jersey.

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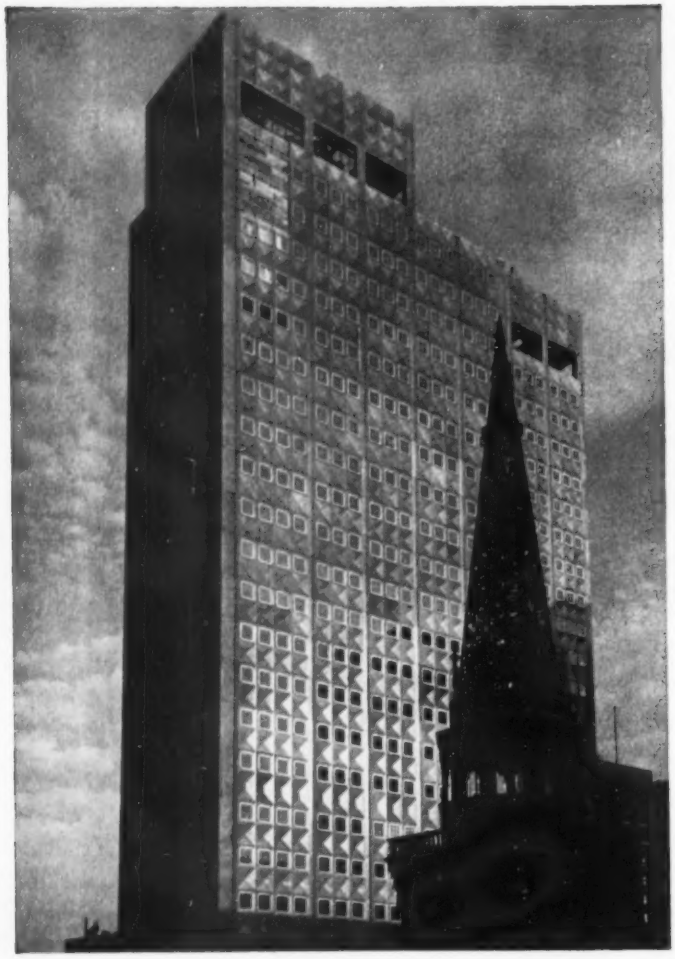

General Contractor says:

Mr. James Murphy, vice president of engineering, The George A. Fuller Company, New York, says, "Because the flooring goes up as Q-Floor raceways are laid, construction costs can be reduced in large buildings, such as Alcoa's 30-story office building."

Electrical Contractor says:

"When we put in a G-E Q-Floor wiring job, we know electric service will never become obsolete. New wiring can be pulled through the many available cells at any time," says Mr. Harry Fischbach, electrical contractor.

The Alcoa Building, Pittsburgh, Pa.—
new home office for Aluminum Company of America

Architects—Harrison & Abramovitz, New York City
Associate Architects—Altenhof & Bown
and Mitchell & Ritchey, Pittsburgh, Pa.
Consulting Engineer—Edward E. Ashley, New York City
General Contractors—The George A. Fuller Company,
New York and Pittsburgh
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Q-FLOOR WIRING

SIZE UP YOUR PLANS for electrical flexibility

Whether you're planning thirty-story or two-story buildings, you can plan ahead for electrical flexibility with G-E Q-Floor wiring.

With General Electric Q-Floor wiring, your buildings will be prepared, throughout their lifetime, for the electrical demands of changing floor layouts.

With G-E Q-Floor wiring the cellular floor *is* the raceway system. That's why tomorrow's unforeseen demands for additional distribution and new power, signal, or telephone service can be met so quickly. Electrical outlets can be added or re-located within six inches of any spot on the floor area . . . at any time . . . in quick time.

For further information on General Electric's Q-Floor Wiring, write to Section C2-218, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

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Product News

Radiant Heating Panel (1)

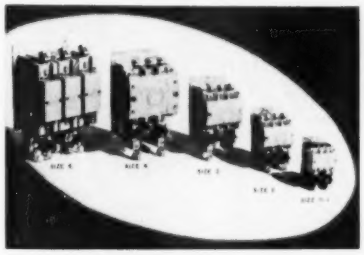
An electrical radiant heating panel only 1/6th of an inch thick which can be cemented to the ceiling like wallpaper. The panel is a sheet of conductive rubber that is the heating unit, sandwiched between layers of thin plastic and aluminum foil. Complete radiant heating for an entire house or for a single room is possible with the panels. They are particularly useful for homeowners who add a new room or who want to supplement existing heat in such places as a den, expansion attic, or garage. The panels are called Uskon, and weigh 6 ounces per square foot. They are bonded to ceilings of plaster, sheetrock or similar smooth material by means of a special adhesive. The number of panels required is determined by climate, insulation, and other factors, but generally, Uskon does not cover the entire ceiling. Three sizes of panels are available, 4-ft by 6-ft, 4-ft by 4-ft, and 3-ft by 4-ft, and both outer surfaces are covered with aluminum foil to keep out moisture. Panels are rated at 22 watts per square foot (75 Btu's) and are available for either 115 or 230 volts. Individual room heating may be operated by thermostatic control, if desired. Panels can be attached to ceilings, without any cutting, rebuilding, plastering, or structural changes. They are then painted with conventional flat interior decoration. The new type panel is ideally suited for expansion attics that are to be made into living quarters.

United States Rubber Company, Rockefeller Center, New York 20, N. Y.

Ultraviolet Lamp (2)

A new high-intensity ultraviolet lamp for installation in air-conditioning systems. The function of this new "Safe-T-Aire" lamp is to create germ-free air to protect humans against infectious diseases and products against contamination. It is easily installed in regular air ducts where the circulating air is exposed to powerful ultraviolet radiations which destroy bacteria, viruses and mold spores. The high-intensity lamp can be installed in multiples as well as singly, to sterilize any volume of air from room size to entire plant air conditioning systems.

Hanovia Chemical & Mfg. Co., 100 Chestnut St., Newark, N. J.



Motor Control (3)

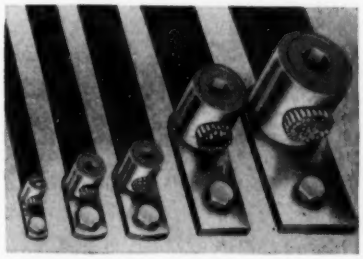
The "RA-V" magnetic motor starter, featuring vertical overloads below the contactor has been added to this line of "RA" motor controls. It is designed especially to be used with the new Crouse-Hinds M52, Type EPC explosion-proof Condulet. Size 2 starter requires only 7-in. Condulet, Size 3 requires only 9-in. Condulet. A size 2 starter simply replaces the inadequate Size 0 or 1 using the same 7-inch Condulet, and without increasing the overall size of the control installation.

Arrow-Hart & Hegeman Electric Co., 103 Hawthorne St., Hartford 6, Conn.

Steel Framing System (4)

A new system of all-bolted steel framing for construction and maintenance work. The line includes a wide range of concrete inserts, pipe rollers and hangers, clamps and other fittings suitable for such diversified applications as tunnel framing, hanging of fluorescent lighting fixtures and other electrical equipment, and for general support and racking in heating, plumbing and air conditioning field. The system consists of a series of specially designed components for construction of all kinds of frames, hangers and racks. The concrete inserts, incorporating one of the four basic channel styles in 12-gauge steel, provide a load carrying capacity of 2,000 pounds per lineal foot. For hanging fluorescent fixtures, use of 12-gauge channels allows hanger rods to be placed on centers up to 15 feet. These channels can also be used as a raceway on interval spaced jobs.

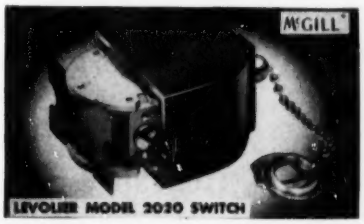
Flexa Steel Products, Inc., 1348-50 West Washington Blvd., Chicago 7, Ill.



Wire Grips (5)

Silver-coated wire grips are available for general distribution. Heretofore, the BullDog wire grip line was produced exclusively for use with the company's own electrical distribution products. The company will conform to its product simplification policy by marketing the wire grips in only five sizes which cover all wire sizes from No. 14 wire to No. 1,000-000 C.M. cable. The company will continue to produce the silver-clad wire grips by the cold-forging method. They will also retain the silvered finish which assures maximum conductivity and cool operation. The two large-sized wire grips are equipped with "saddles" that fit the curvature of the cable. Serrations on the saddles provide better gripping as well as better contact.

BullDog Electric Products Co., Detroit 32, Mich.



Switch (6)

A new 20-amp switch for controlling heavy loads in industrial and commercial electrical service has been added to this line. Known as the Levolier Model 2020, it is a universal-lever operated pull switch with ac and dc rating. Only 1¼-in. thick and 2-in. wide, it will carry 2500 watts at 125 volts. It meets all Underwriters' Laboratories requirements including overload and breakdown tests and is fully approved. Switch has a single pole, multiple break, snap-action mechanism which breaks at 4 points simultaneously to reduce arcing. It is designed for safe, positive control of heavy current applications and will control up to 250 watts on heaters, motors, high-bay lighting, fluorescent banks, etc. It fits standard outlet boxes.

McGill Manufacturing Co., Inc., Valparaiso, Ind.

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Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

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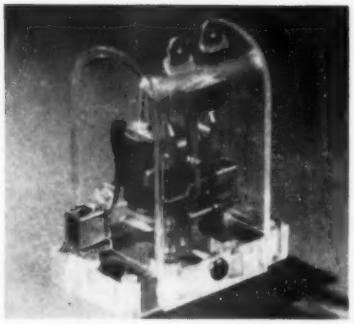
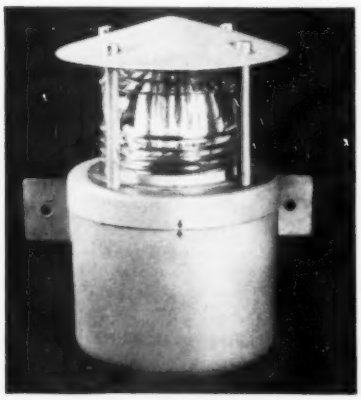
Chicago 12, Illinois



Overload Relay (7)

A new type of overload relay combining high speed operation under dangerous conditions with time delay for starting inrush. Type C Silic-O-Netic relay can be furnished with time delay curves to match the characteristics of the protected equipment. It is used for protecting hermetically sealed motors, electronic circuits and control systems. Type C relay has a hermetically sealed brass tube extending through and beyond the solenoid coil. The tube, in turn, holds a movable iron core and is filled with a silicone liquid. On starting inrush or small overloads, the magnetic force is not sufficient to attract the armature. It does, however, draw the core into the field at a rate controlled by the viscosity of the silicones. When the core reaches the pole piece the relay responds, providing delayed response. On large overloads, the core is not a factor and relay operation is instantaneous. Relays are insulated for 440 volt service with coil ratings from 1 to 100 amperes. They are furnished in tamperproof phenolic housings.

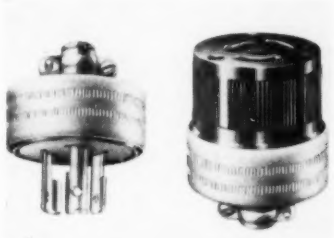
Heinemann Electric Co., 435 Plum Street, Trenton 2, N. J.



Control System (8)

A new photoelectric control system that provides automatic regulation of artificial lighting. They have been designed for use in regulating illumination of street lighting, obstruction markers, airstrip lighting, indoor lighting, outdoor advertising sign lighting, industrial and many other applications where lighting controls are required. Equipment is for 105 to 125 volt, 50 to 60 cycle power lines and is designed to "fail safe" in the event of any component or tube failure. Provided in the controls is a time delay circuit to preclude effects of lightning flashes, passing automobile headlights on flashing signs. The equipment is designed to operate uniformly under all conditions of temperature and humidity normally encountered in this type of service. An internal instrument fuse is provided for equipment protection, and is designed to withstand high voltage surges up to 3,000 volts rms. The load relay is positive and chatter-free in operation and is available in 500 watt and 3 kw tungsten lamp load ratings. The control unit utilizes a high-vacuum, blue sensitive phototube.

Solartron Corporation, 540 East 80th Street, New York 21, N. Y.



Wiring Devices (9)

New 3-wire Turn-and-Pull "Royalok" polarized caps and connectors have been added to this line. They have adjustable cord grips for cord diameters from .325-inch to .562-inch, and are used primarily with heavy-duty, rubber-jacketed service cords. They are UL listed, rated at 20 amp, 250 volts, 10 amp, 575 volts, and will fit other standard makes of interlocking devices.

Royal Electric Company, Inc., Pawtucket, R. I.

Air Conditioning Equipment (10)

A new line of residential year-round air conditioning equipment, offering over 190 models in a wide range of heating and cooling capacities that can fit the year-round indoor climate requirements of any size house in any part of the country. The air conditioners are self-contained packaged units and are finished in two-tone gray. The smallest unit takes up only 8.3 square feet of floor space and the largest occupies 15 square feet. The unit automatically cools when it is hot, dehumidifies when it is muggy, and heats when it is cold. Master thermostats control the temperature. The new line of year-round air conditioners and separate self contained air conditioning units are both designed for use with GE's air-wall system of heating and cooling as well as for conventional cooling and heating distribution systems.

General Electric Company, Bloomfield, N. J.

Tester (11)

A new model 52 V.A.O. tester with four testing ranges: volts, ac and dc: 0-10, 0-50, 0-250, 0-1000, ac only: 0.2-5; amperes, dc only: 0-10; ohms 0-1000, 0-10000; megohms: 0-1, 0-100. A selector switch provides four positions: volts ac, volts dc, ohms, amps. Range switch has five positions which provide for above 5 voltage ranges, 5 ohm ranges, and 1 ampere range. Two pairs of sockets for plugging in test leads are marked: test leads are 4 feet long and furnished with both prods and alligator clips. Dimensions are 8⅛-in. by 4¼-in. by 2½-in. Instrument housing is insulated and unbreakable, also shock and acid-resistant.

Martindale Electric Co., 1309 Hird Ave., Cleveland 7, Ohio

Intercommunication System (12)

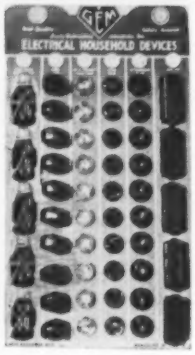
A new 20-watt Redi-Power Talk-A-Phone, featuring a baseboard mounted power supply. The new power supply, will deliver up to 20-watts output, and is self-compensating to deliver required power to all or a select group of stations, supplying power to each station when called simultaneously as well as individually. The power supply eliminates the need for a separate booster or paging system and does away with the need for a larger cabinet. The unit also features multi-magic selector; dynasonic universal feature; hold-a-matic conference control; uni-trans dictation control. A safety fuse, fusing the unit on both sides of the line also is incorporated. 12, 20, 30 or 40 station capacity can be housed in the same cabinet with only 12 pushbuttons, while with the dynasonic universal feature the system can be expanded or changed at any time to handle new situations or requirements without discarding the original equipment.

Talk-A-Phone Co., 1512 So. Pulaski Rd., Chicago, Ill.

QUALITY GEM GUARANTEED
Your Assurance of BEST QUALITY for SAFE USE

Sell Visual Displays
More Sales & Profits
Electrical Household Devices

FAST SELLING ITEMS USED IN EVERY HOUSE HOLD CAT.NO. 850 BROWN



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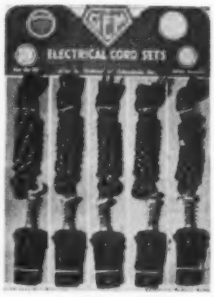
Electrical Cord Sets

10 TO DISPLAY 5FRONT 5 BACK

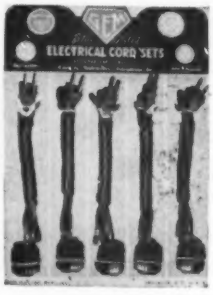


CAT.NO 430 432 450 452 454 456 ADD 10-D

SIX FAST SELLING SWITCH AND SWITCHLESS CORD SETS THE MOST DIVERSIFIED SELECTION

Extensions
A TYPE AND SIZE FOR EVERY PURPOSE

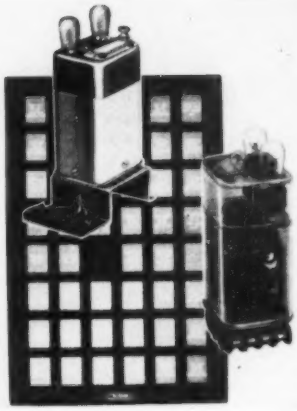
10 TO DISPLAY 5 FRONT 5 BACK



CAT.NO B-L 707 708 714 717 718 719 ADD 10-D

SIX TYPES THREE SIZES 6-9-12 FT.
LARGER ON REQUEST

Listed by Underwriters' Laboratories Inc.
SOLD THROUGH ELECTRICAL WHOLESALERS
THE FACTORY
AND KNOW-HOW BEHIND
MAJOR
PLUG AND CARTRIGE
FUSES
GEM ELECTRIC MFG. CO., Inc.
237 - 37th Street Brooklyn 32 N Y U S A



Relay (13)

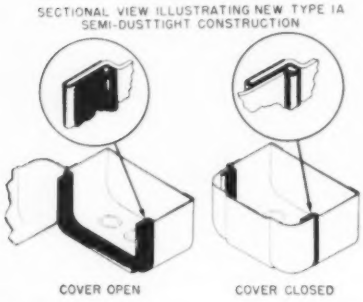
All-purpose enclosed signal Tel-Alarm relay plug-in units. They are completely enclosed, dust proof, and may be taken apart. These new "LPG" relay units are flexible and versatile. Over 100 standard circuits are available, many with universal features permitting changes in the operating sequences in the field with simple terminal connections. With their unitized system of construction, these "LPG" units can be assembled into any number of multiple stations from a single unit to many hundreds in the same system.

Tigerman Engineering Co., 4332 N. Western Ave., Chicago 18, Ill.

Radio Equipment (14)

The Federal Communications Commission recently announced its first specific FCC Class "A" Citizens' Band type approval on mobile and base station radio equipment for operation in the 460-470 Mc. frequency band. Class "A" operation is within the frequency range from 460 to 462 Mc. and from 468 to 470 Mc. and is limited to a transmitter final amplifier power input of 50 watts. This approval opens new channels to all individuals or commercial enterprises who need two-way radio. The mobile and base station equipment, incorporates many of the same features included in the manufacturer's equipment operating in the lower frequency bands. The receiver circuit includes the "Sensicon" circuit with the Permakay filter which guarantees permanent selectivity under all conditions of temperature, humidity and vibration. The receiver includes a total of 21 tubes and uses only 5 tube types. The transmitter, which has a nominal power output of 20 watts, employs nine tubes.

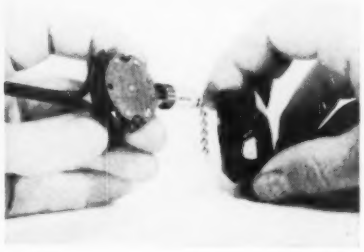
Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill.



Control (15)

A newly designed, NEMA 1-A enclosure is now being used to make GE ac combination motor starters lint-tight. The enclosure features an oil-resistant (Buna S) rubber gasket which is preformed to fit over the edge of the control case. When cover is closed, gasket acts as a seat on which the cover rests. A close seal is thus formed, preventing the entrance of lint and minimizing fire hazard. The "U" shaped gasket forms a compression seal that can be inspected easily without opening control case. A gasket for the reset button is provided and all corners and small drain holes which may remain in the case after fabrication are sealed with a metal filler.

General Electric Co., Schenectady 5, N. Y.



Switch (16)

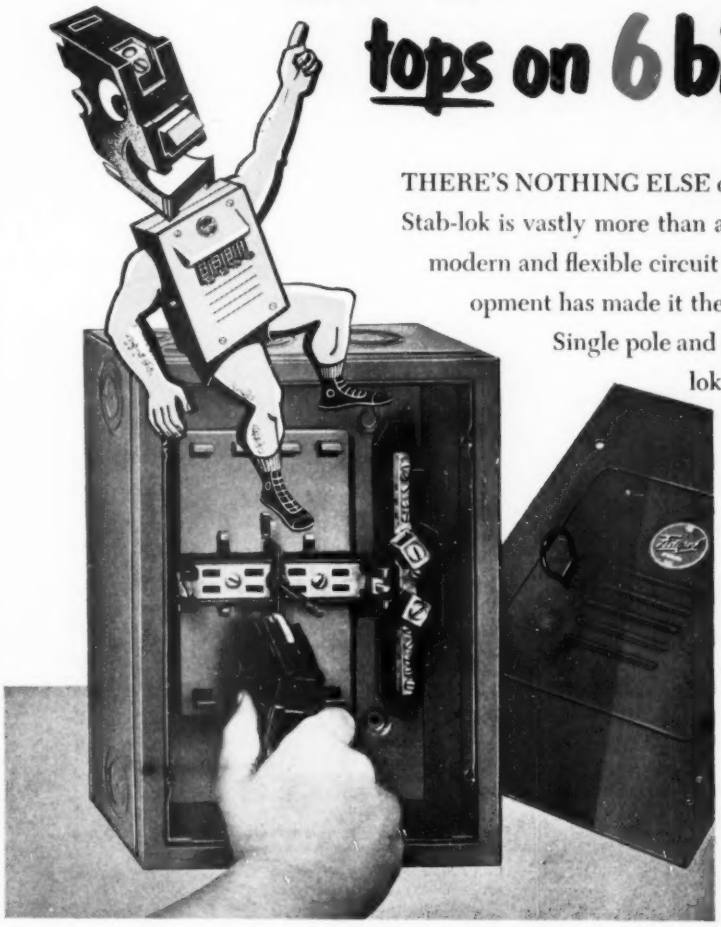
A new one piece molded phenolic case has been added to Model 41 Levolier switch that makes the switch easier to wire and install. Loosening one round, milled-edge nut permits the case to be removed from the switch mechanism. This exposes the two terminal posts for quick wiring. It is "T" rated by Underwriters' Laboratories, Inc. Only 5/8-in. thick, it is lever operated from any angle. Easily mounted without screws, the switch is widely adaptable for individual control of incandescent or fluorescent lighting and for FHP motor control.

McGill Manufacturing Co., Valparaiso, Ind.

"Stab-lok's

REGISTRATION APPLIED FOR

tops on 6 big counts!"



THERE'S NOTHING ELSE on earth like Federal Noark Stab-lok. Stab-lok is vastly more than a circuit breaker... it's today's most modern and flexible circuit protection system. Constant development has made it the most complete line on the market. Single pole and double pole simultaneous trip Stab-lok breakers come in a standard 15 to 50 amp. range of calibrated ratings. The double pole breaker is exactly twice the width of the single pole, and both are readily interchangeable.

And now look at the full combination of six big advantages that you get *only* with the Stab-lok system! For absolute dependability, perfect adaptability and lowest installation cost, join the stampede to Stab-lok—today.

1 **BIG, FULL-SIZE BREAKER.** There's no skimping in size. Stab-lok is a big, husky, breaker. Independent tests show it uses metal where it counts, *carrying current;* has fewer and more rugged parts.

2 **MILLIONS TESTED.** Stab-lok's dependability has been proved under every sort of service condition and on millions of installations. It's the one popular breaker in which you can place full confidence.

3 **COMPLETE RANGE.** Only Stab-lok system gives a full range of 9 basic and many special enclosures. 3MBA, for example, converts a multibreaker into a Stab-lok, easily, economically.

4 **LOWEST INSTALLED COST.** Stab-lok is easiest, most economical to install. Enclosures have ample wiring space... backplate removable for wire pulling... all components accessible.

5 **4-WAY STABS.** The stabs are an exclusive Noark feature; provide safest, easiest method of breaker insertion. 4-way stabs make positive contact with special main busses and lock into place instantly.

6 **COMBINATION FLUSH-SURFACE ENCLOSURES.** Most Stab-lok enclosures are combination type for flush or surface mounting. This practically halves the stock of enclosures needed for all requirements.

Write for full information... and order Stab-lok from your distributor

FEDERAL ELECTRIC PRODUCTS COMPANY
50 Paris Street, Newark 5, N. J.

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Federal NOARK

TOPS
FOR SINGLE-PHASE JOBS

Motors—Power Performance
Controls—Protective Control

Get top single-phase motor performance and protective motor control with Westinghouse capacitor motors and reliable controls.

CAP motors—(1 to 3 hp) . . . and CAP-2 motors—(5 & 7½ hp) have ample starting torque to master your toughest application. They're constructed with pre-lubricated, factory-sealed bearings . . . die-cast rotors . . . and all-steel frames and brackets. These features are but a few which assure years of stamina with very low maintenance.

Both Life-Linestarter® and Motor Watchman® use the same line of overload relay heaters, reducing replacement heater inventory. Their straight-through wiring and many knockouts make them easy to install for any application.

Working together, these motors and controls spell dependability and economy! Put 'em to work and save!

Learn the many other facts and features of these Westinghouse Motors and Controls. Ask your Westinghouse representative or write for free booklets B-5441 (covering motors), B-4677 (covering Life-Linestarters) or B-5256 (covering NEMA 1-A Motor Watchman), Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-21675-A

MOTOR FEATURES:

Pre-lubricated . . . factory-sealed bearings. Grease sealed in, dirt sealed out. You never need lubricate these bearings.

Die-cast rotors have no windings to burn out or break . . . no brushes to adjust or replace.

Built-in capacitors give high-starting torque for heavy loads with low-line voltage drop. CAP-2 motor has running, as well as starting, capacitor.

All-steel construction assures high-shock resistance . . . makes a smaller, lighter motor.

Tuffernell® insulation of maximum dielectric strength, gives protection against moisture, abrasives and mild chemicals.

CONTROL FEATURES:

Foolproof overload protection provided by snap-action bimetallic disc. Permanently retains calibration.

"De-ion®" arc quenchers . . . extinguish arc in ½ cycle or less. Contacts last longer . . . give trouble-free service.

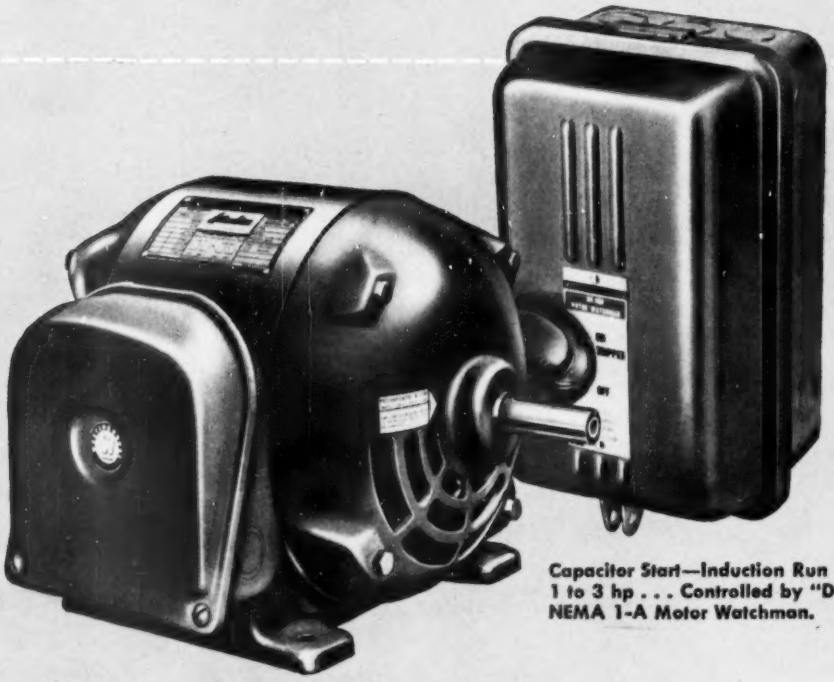
Quick-make, quick-break over-center toggle mechanism on Motor Watchman . . . reduces arcing time, maintenance costs.

Straight-through wiring has line leads at top . . . load leads at bottom. Ample wiring space and knockouts speed installation.

Motor Watchman safety latch holds switch in "Off" position, protects when servicing.

YOU CAN BE SURE . . . IF IT'S
Westinghouse

Capacitor Start—Capacitor Run Motor, 5 and 7½ hp . . . Controlled by the Life-Linestarter.



Capacitor Start—Induction Run Motor, 1 to 3 hp . . . Controlled by "De-ion" NEMA 1-A Motor Watchman.

switchgear
(drawout or stationary)

"Concentrol" motor control centers

panelboards

feeder & plug-in bus duct

unit substations

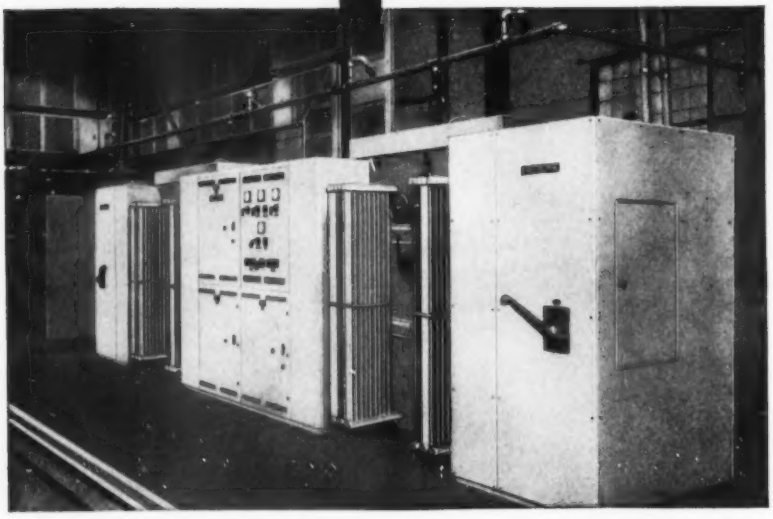
instrument panels

"Weather-Loc" enclosures

theater switchboards

wireway

• • • the modern, low-cost "packaged" method of supplying power. This Continental installation is a 3000 KVA Double Ended Unit. With Continental equipment, you can coordinate your complete electrical distribution system. And, Continental craftsmanship gives you top performance and appearance value.



DATA ON INSTALLATION PICTURED
High voltage sections: Load Break Air Interrupter Switches.
Transformers: Askarel Immersed, 1500 KVA, 3-Phase, 12,000-480 V.
Switchgear: 600 V., Drawout Type Air Circuit Breakers.
Bus Duct: Continental Low Impedance Feeder Bus Duct.

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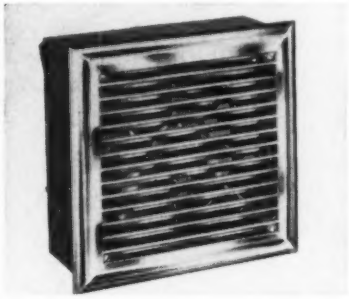
Specify Continental . . . with Confidence!

Gate Operator (17)

Sliding gate operator, Model LSG-Series, features the magnetic remote control, which allows drivers to open and close gates from moving vehicles equipped with Robot coil. Driveway lights can be synchronized with all remote controls. The commercial door operator Model LSG is available in four different sizes, depending upon the square foot area and weight of gate to be handled. It has sufficient adjustment to provide a 60 second cycle in either direction, thereby, giving 90 feet of travel at 1½ ft. per second. The speed of gate travel can be altered in field by changing size of motor and drive pulleys. Eleven different types of remote controls are available: toggle switch; one, two, and three pushbutton stations; key switch; pull switch; foot-pressure; drive-over; photoelectric eye; magnetic ground switch; and automatic reversing safety control.

Robot Appliances, Inc., 13165 Prospect Avenue, Dearborn, Michigan.



Wall Fan (18)

New Motordor wall fans, No. 11, 10-inch diameter and No. 80, 12-inch diameter. They feature the insulated, motorized Motordor operated by a remote control switch which actuates a reduction gear mechanism, opening the Motordor as the fan starts and remains closed when fan is not in use. Finish of "Fantom-Gril" is chrome plated or white enamel. It also features an adjustable wall sleeve for various wall thicknesses. The No. 11 fan moves 600 cfm and the No. 80 moves 900 cfm. Both are equipped with non-radio interfering, 1550 rpm, 115 volt, 60 cycle, ac motors.

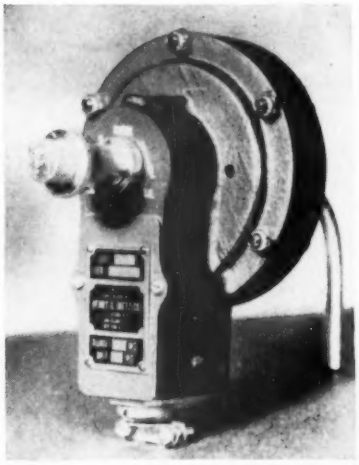
Broan Mfg. Co., Inc., 1669 N. Water St., Milwaukee 2, Wis.

Solvent (19)

A new solvent called Shaler Generator-Motor cleaner, cleans electric motors and generators while they are still assembled. Motors and generators can be cleaned two different ways, with this solution: (1) A motor can be completely submerged in the cleaner, then plugged into electric current and allowed to run for from three to five minutes. The motor is then removed from the dip tank and dried

with compressed air. (2) Cleaner may be sprayed into the intake side of a motor, while it is in operation. Motors which have been accidentally submerged in water as a result of fires, flood, etc., may be cleaned without "baking".

The Shaler Company, Waupun, Wis.



Controls (20)

The new Cat. 101P sensitive static pressure controls are an improved version of the original Cat. 101 controls. New unit employs a silicone impregnated glass cloth diaphragm allowing operating at high or low temperatures over long periods of time. Controls are for application on very low pressures where regulation is required in inches of water. Units are of small physical size, obtainable in standard ratings ranging from 0-in. to 20-in. of water pressure with range adjustment and with fixed differentials from .2-in. to 2-in. water. Approved by Underwriter's Laboratories for 10 amp 125 volt or 5 amp 250 volt, ac. Installation requires only one hole to mount on a vertical wall or duct.

The Henry G. Dietz Company, 12-16 Astoria Blvd., Long Island City 2, N. Y.

High Speed Silver (21)

All types of electrical connections or joints including aluminum can be made trouble-free with high speed silver. Its high density, purity and molecular bond not only prevents overheating and voltage drop but also increases current capacity, reduces or eliminates fire and explosion hazards. It can be applied anywhere, on assembled or unassembled equipment. Operates directly from a 6 or 8 volt battery charge or booster, from batteries or a Rapid rectifier. Work is prepared with emery cloth, steel wool or a wire wheel; aluminum with Rapid aluminum activator.

Rapid Electroplating Process, Inc., 1414 South Wabash Ave., Chicago 5, Ill.

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GUTH
PEER-LITE
MODERN AS TOMORROW IN DESIGN AND LIGHTING EFFECT
PEER-LITE fixtures offer great flexibility. Pattern Planning is unlimited—you can form T, H, □, +, I... any design you wish.
PEER-LITE has 20% uplight. Top plates for 100% downlight can be provided. Luminous side panels add beauty and comfort.
For 2, 3 or 4 lamps—4' or 8' long.
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SEE HOW VERSATILE PEER-LITE IS:
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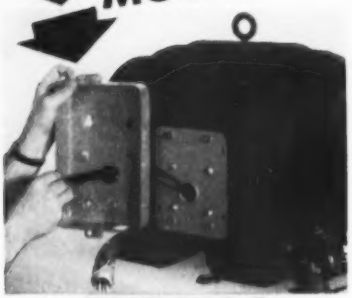
Quick and easy STARTER MOUNTING



FURNAS
Motor-Mount
STARTERS

These magnetic controls may be mounted on the motor outlet-pad face to provide sturdy, safe, out-of-the-way installations AT ANY MOTOR POSITION. They're a final solution to the direct-to-motor mounting problem and an excellent idea for machines and equipment having limited space . . . Motor Mount Starters and Contactors are ready for immediate delivery in Furnas sizes YC, YD and YE up to 10 hp. Write Furnas Electric Company, 1067 McKee Street, Batavia, Illinois.

ONLY A SINGLE FURNAS ADAPTER PLATE is required for motors with outlet-pad face in the vertical position or at any angle up to 45 degrees from the vertical.

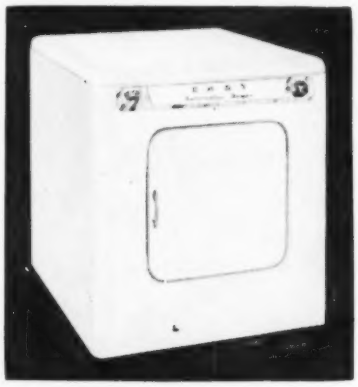
THE FURNAS COMBINATION ADAPTER BOX and either the reversing or non-reversing adapter plate accommodates motors with outlet-pad face in the horizontal position or at any angle up to 45 degrees from the horizontal.

FURNAS Electric MOTOR CONTROLS

Brush Cutter (22)

An electric saw for cutting brush and undergrowth which hampers right-of-way clearance. It has an air-cooled, two-cycle motor. Circular saw blades can be replaced in seconds. The entire machine, easily carried by one man by a sling suspension type belt, weighs 35 pounds. No moving parts of motor are exposed; there is an angular bar which prevents operator from moving into blade; there is an engine throttle located at hip for quick engine control, and an automatic clutch disengages saw when engine is idling.

Brushmaster Saw Company, 290 West Street, Keene, N. H.



Clothes Dryer (23)

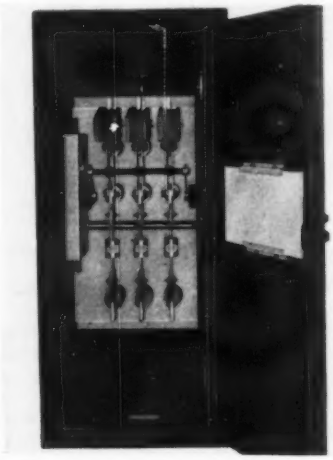
A new electric automatic clothes dryer, Model DE-52. Selecto-Matic control operates on degree of dryness required by means of a humidity temperature control. Thermostat automatically shuts off heating element when exhaust air temperature reaches 185° F or 135° F. Motor shuts off when temperature inside dryer has dropped another 25°. Circle-Aire drying features vacuum or suction system. Open-type nickel-chrome wire coil mounted on porcelain insulators provides overhead radiation, removing 10 lbs. of water per hour. Clothes are sanitized by germicidal, infra-red rays. Weight is 170 lbs. It has a 16-inch front. Heating element is 4500 watts, 230 volt, cylinder-opening. Motor is 1/6 hp, 115 volt, 60 cycle ac, with thermal overload protection. Price is $249.95.

Easy Washing Machine Corp., Syracuse 1, N. Y.

Freezers (24)

Low temperature testing is practical for any size laboratory or test department with the new XV-70 Series industrial chilling machines. Unit will hold any temperature from —10 to —70 degrees F. and has a thermal capacity of 550 Btu per hour. It is available in chilling chamber sizes ranging from 5 down to 1.5 cubic feet. Since unit is designed primarily for testing, the largest chilling chamber dimensions are 30-in. by 18-in. by 16-in. deep. Of all-steel construction, XV-70 has a chilling chamber wall of 3/16-in. steel to facilitate the handling of heavy or sharp-edged metal parts.

Sub-Zero Products Company, 3930 Reading Road, Cincinnati 29, Ohio



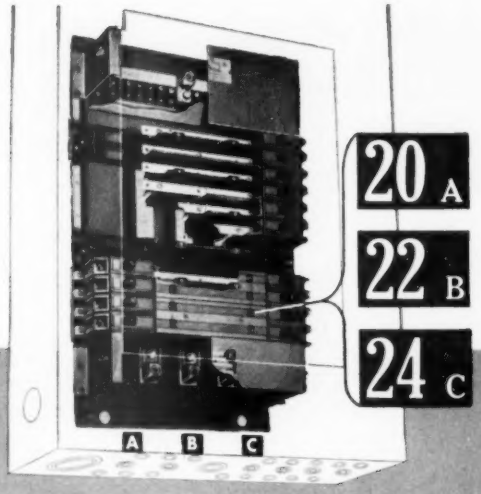
Switch (25)

A new metal enclosed Dis-ruptor switch for 600 volt ac or dc service, combines the functions of disconnect and load interrupter. With its arc-ruptor chamber and quick-make, quick-break mechanism, the Dis-ruptor offers safe, positive load interruption. Switches are available in ratings of 400, 600, 1200, 2000 and 3000 amperes—two-pole or three-pole units with or without provisions for "Amptrap" fuses.

Delta-Star Electric Division, H. K. Porter Co., Inc., 2437 Fulton St., Chicago 12, Ill.

Door Control (26)

An electrically operated hydraulic door control, called "Invisible Dor-Man". It opens any type of door (glass, wood, or metal) the instant a person steps on the carpet leading through the doorway. The door remains open until the person has walked through, and then closes with a two-speed action. That is, the initial closing speed is reduced during the last few inches of closing to assure noiseless operation. These speeds are adjustable at time of installation. The new system consists mainly of the door control mechanism which is concealed in the floor, and



Circuit breaker panelboards, of course, but...

Westinghouse permanent phase identification saves installation and maintenance time

Westinghouse Panelboards provide modern, labor-saving control of lighting and appliance branch circuit power distribution, electrically and mechanically.

For instance, no guesswork is required to determine the connections between branch circuits and main bus on standard 3-phase, 4-wire lighting Panelboards. Each circuit and the bus to which it is connected is clearly, permanently identified. Eliminates time-consuming ringing-out of circuits. Simplifies installation, wiring or rewiring for future circuit changes.

For the quality that delivers power effectively, cuts outage time, speeds installation and maintenance, look to Westinghouse Factory Assembled Panelboards.

More facts? Call your Westinghouse Distributor, or write for DB-30-930, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

J-93476

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APPARATUS DISTRIBUTOR WESTINGHOUSE

"DE-ION" BREAKER PANELBOARDS

You simply can't beat this new

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Spiral for smooth easy reaming

★This new improved Spiral reams burr from conduit or pipe as fast and cleanly as if they were wax . . . and makes quick work of enlarging conduit box outlets or cutting holes in sheet metal—and does it without chatter.

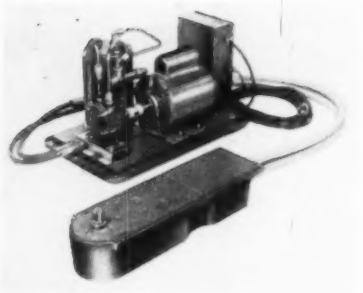
★Improved ratchet handle—cutting edges of heat-treated tool steel for long service. You can't beat it for performance. Buy at your Supply House.

Remember also RIDGID LonGrip Reamer with extra-long taper.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID

Work-Saver Pipe Tools



the hydraulic power unit, equipped with GE Form G ½ hp motor. Power unit can be hidden from view at any distance from the door. The electric cord is plugged into any standard 110 volt, ac circuit. In case of power failure, the door will operate manually.

Dor-O-Matic Division of Republic Industries, Inc., 4440 North Knox Ave., Chicago 30, Ill.

Clothes Dryer **(27)**

A new automatic electric clothes dryer. It features waterfilm drying action; safety door; full-opening door; variable heat control, flexible timer; double insulation; and moisture proof heating units. Dimensions are 36 inches high, 31½ inches wide and 26½ inches deep. Capacity is 18 pounds wet clothes, 9 pounds dry clothes. Door switch shuts off heat, motor and timer when door is opened. A 40-watt bulb lights dryer interior when door is open. Weighs 211 lbs. Rating is 230 volts ac, 60 cycle, 4800 watts. Motor is 1/6th hp with built-in overload protection.

The Maytag Company, Newton, Iowa

Product Briefs

(28) A half-wave **rectifier** designed for use in high-voltage rectifier circuits has been added to the industrial tube line of General Electric Company, Syracuse, N. Y. . . . . (29) An electronic repeat cycle **timer** suitable for regulation of automatic machinery, sampling, valve pacing and heat sealing as well as laboratory testing such as heat cycling and refluxing, is available

CHLORINE CELL
PLATING RACK
CADWELD® LUGS OR YOUR
OWN FABRICATED BAR STOCK
PLUS
A
CADWELD®
CONNECTION
EQUALS
TRACTION MOTOR
FURNACE DISCONNECT
POWER LEAD
THE FINEST TERMINAL
CONNECTION ON THE MARKET
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– Cannot loosen or corrode
– Unequaled mechanical properties
– Installed with inexpensive lightweight equipment
The Answer to Design Problems and Special Applications
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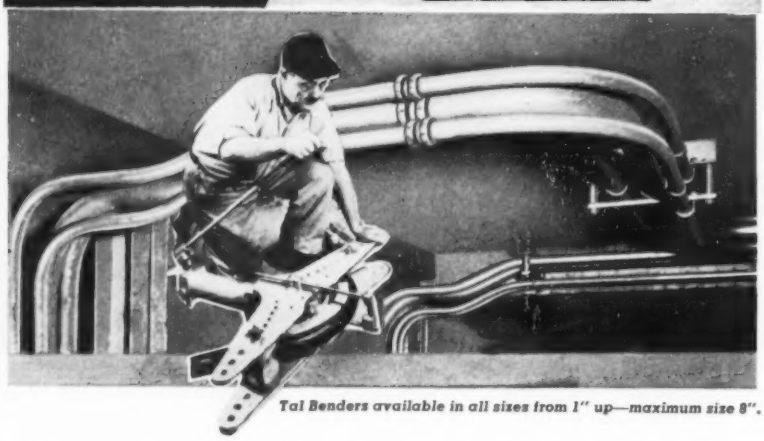
ERICO PRODUCTS, INC.
2070 E. 61st Place • Cleveland 3, Ohio

TAL PORTABLE BENDERS

BEND THINWALL or RIGID CONDUIT FASTER



Tal Benders available in all sizes from 1" up—maximum size 8".

You can earn bigger profits by reducing up to 80% the number of elbows and couplings otherwise needed. Save on cutting, threading and installing. This is possible with a Tal, because Tal Portable Benders make any degree bend in *one setting without shifting the conduit* . . . and do the job faster!

No guesswork for offsets, long sweeps or any other bends. No experience necessary to make accurate, wrinkle-free bends quickly, right on the job.

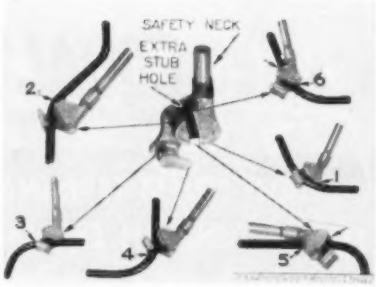
No spoilage. Bend indicator assures identical repeat bends without measuring.

Actual bending time of a 90° bend in 3" conduit with a motorized Tal Bender—1 minute, 51 seconds. Other sizes in proportion. Assembly time of a Tal Bender (2 parts only)—less than 1 minute.

Learn today how you can earn more money and handle more jobs with a Tal Portable Bender.

TAL 6-WAY HICKEY FOR RIGID CONDUIT

Exclusive design of the six non-slip bending jaws assures perfect elbows, offsets, loops, saddles, stubs and sets in close quarters or on open slab work. No effort, no kinks. The bending jaw grooves of this "Safety-First Hickey" are slip-proof, and long safety neck prevents it from breaking at the threads. Has extra stub hole for bending conduit protruding from concrete. *Guaranteed for life against breakage.*



Nos.	Size	Weight	Package Price of Ten	Unit Price
50	½"	3½ lbs.	$3.10 ea.	$3.70 ea.
75	¾"	5 lbs.	3.90 ea.	4.65 ea.
100	1"	8½ lbs.	Package Price of Three 6.65 ea.	7.95 ea.

COMPLETE LINE OF BENDERS
For rigid conduit up to 5 *inch* and small Combination Production Benders for Rigid and Thinwall Conduit, for ½" and ¾".

WRITE FOR THIS FREE BULLETIN

Tal Bender, Inc. Dept. 21 Milwaukee 2, Wis.

from F. C. Wilson & Co., Chatham, N. J. . . . . (30) American Mercantile Co., Inc., New York City, has announced a new sub-miniature **soldering instrument,** known as ORYX, which is suitable for low-voltage soldering in the electronics field.

(31) The Jasper Blackburn Corporation, St. Louis, has anounced a new chemical process for increasing the mechanical efficiency of split-bolt **connectors** made of copper alloys. . . . . (32) Mall Tool Company, Chicago 19, Ill., has introduced a new model 4EW electric impact **wrench.** . . . . (33) Centrifugal **blowers** in models to meet a wide variety of air-moving needs have been added to the line of fans and blowers manufactured by Hartzell Propeller Fan Company, Piqua, Ohio.

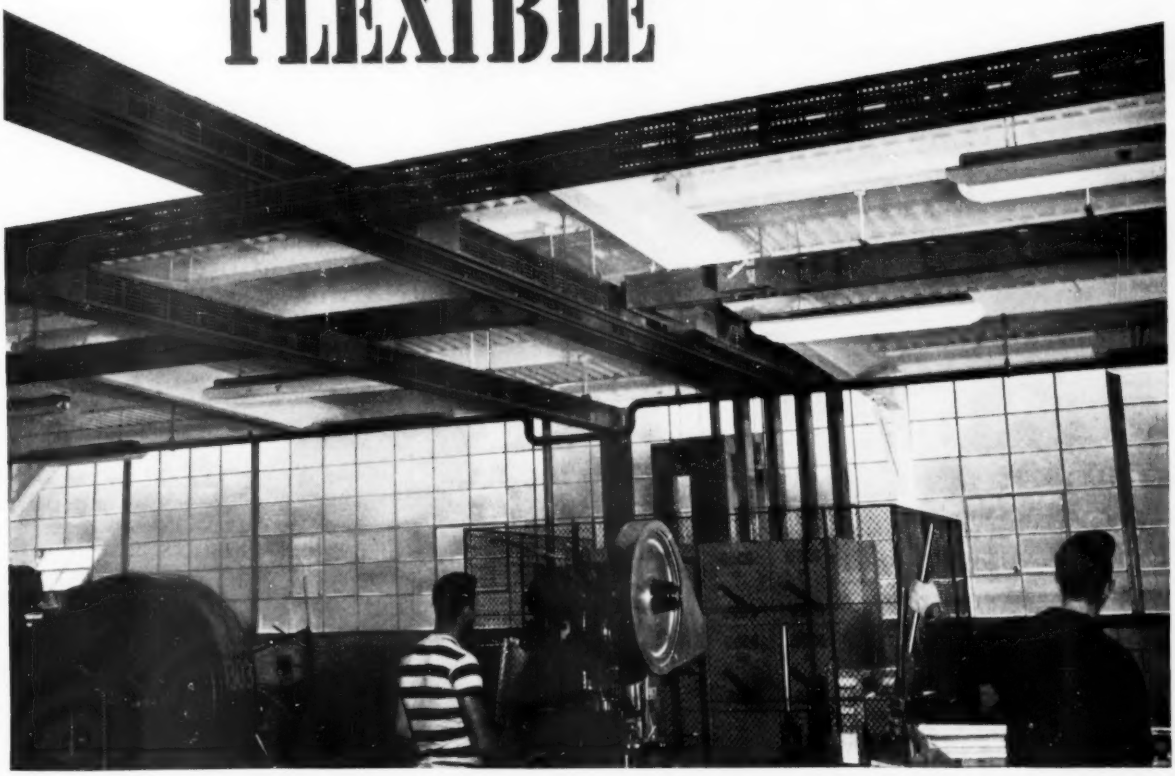
(34) Service Metal Fabricators Company, Beverly Hills, Calif., is now marketing a new constant temperature **control bath machine** that will maintain any desired temperature within ¼ degree F. maximum variation. . . . . (35) The new Utica angle **locknut pliers** No. 750-8 in. does three special jobs for electricians—it tightens locknuts in outlet boxes; removes burrs from steel tube or conduit, cuts and skins rubber covered wire. Manufactured by Utica Drop Forge & Tool Corporation, Utica, N. Y. . . . . (36) Kapner Hardware, Inc., New York 29, N. Y. has introduced a **testing tool** that permits instant tracing of cause of trouble in the high voltage section of any TV receiver.

(37) Bantam-sized Class "S" **relays** manufactured by Automatic Electric Sales Corp., Chicago 7, Ill., are now available in a new small hermetically-sealed enclosure.

(38) The Maxaw 800 saw with 8¼-inch blades has been introduced by Cummins-Chicago Corp., 4740 N. Ravenswood Ave., Chicago 40, Ill.

INSPECTION ACTIVITY in the Rockford, Ill., industrial area gets attention of: (L to R) electrical contractor Roy F. Diehl, inspector W. M. Schoknicht and electrical sales supervisor S. A. Coxhead, both of the Central Illinois Electric and Gas Co., at Rockford.

BUS DUCT IS FLEXIBLE



"It's So Flexible To Plant Layout..." says The Randall Company

The Randall Company officials stated, "It's so flexible to plant layout and production line shifts that it's just what we need for future changes and expansion."

"The ease of installing your Bus Duct was amazing . . . it saved us both time and money," said the contractor, Mr. Edward P. Fogarty, President of Fogarty Electric Company, Cincinnati, about this job.

This large installation of Westinghouse Low Impedance and Plug-In Bus Duct is in the Randall Company plant at Wilmington, Ohio. It is assembled from standardized sections that allow rapid dismantling and reassembly without waste of time; duct is fully salvageable.

Up to 5,000 amperes, Westinghouse Bus Duct provides more power per pound of equipment than any system of wireway, cable or conduit. Four types are available to handle all load requirements, meet all service conditions in your plant or building from power source to outlet.

Get complete facts by calling your Westinghouse Distributor or write for B—5835, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-30108-A

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DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

APPARATUS DISTRIBUTOR WESTINGHOUSE

BUS DUCT

So Easy...

yet you can't make a **STRONGER SAFER PIGTAIL SPLICE!**

- No Special Tools
- Only ONE Piece to Handle
- Twists — Threads — Grips — Insulates ALL AT ONCE

IDEAL Wire-Nuts®

Patented, No. 1,933,555
THE SOLDERLESS, TAPELESS WIRE CONNECTORS

Now Better Than Ever!

Contractors' favorite for almost 30 years, IDEAL "Wire-Nuts" have been improved and redesigned to give you still greater advantages and ease of use:

New phenolic compound shells are stronger — have higher dielectric . . . *New buttress threads* guide wire insulation snugly into generous skirt . . . *New knurling* makes it still easier to screw down "Wire-Nuts" for shake-proof, pull-proof splices . . . *New automatic machine assembly and inspection* eliminate all chance of imperfection due to human error.

Only IDEAL makes "Wire-Nuts"—the perfect time-tested connectors that protect *your* reputation. Be safe and sure on every job—USE "WIRE-NUTS."

Spliced for Life!

Contractors sizes 74B and 76B are fully approved as pressure cable connectors for general use in all types of branch circuit wiring.

● Sold Through America's Leading Distributors

MAIL FOR FREE SAMPLES

IDEAL INDUSTRIES, Inc.
1041 Park Avenue, Sycamore, Illinois

Please send FREE SAMPLES OF IDEAL "Wire-Nuts."

Name_____

Company_____

Address_____

City_____ Zone___ State_____

CATALOGSand BULLETINS

(39) TIMING RELAYS, including dashpot, pneumatic and electronic timers, are illustrated and described with operation and engineering data in 16-page bulletin showing various enclosures and a chart for selecting timing relays. Allen-Bradley Company.

(40) INCANDESCENT LIGHTING for commercial interiors is the subject of 60-page catalog on planning and specifying installations, including product illustrations, performance statistics, lighting calculations, mechanical construction with cross section drawings, installation methods and general engineering data. The Art Metal Company.

(41) WIRING REELS, extension cord reels, store room reels, wire meters, joist boring machines, knockout trimmers and reel lifts are illustrated, described and priced in 8-page catalog. Hykon Mfg. Co.

(42) INSTRUMENT MOTORS, synchronous and non-synchronous, timing motors and gear motors are illustrated and described in 10-page bulletin, including temperature controls, rating charts and mounting dimensions. Gleason-Avery Inc.

(43) INDUSTRIAL LIGHTING is the subject of Bulletin No. 8 in the "See Better—Work Better" series, covering the concept of balanced brightness and sufficient light over the work area and pointing up improved industrial lighting techniques. General Electric Co.

(44) CURRENT TRANSFORMERS, indoor-outdoor, are illustrated and described in 12-page application guide on transformers with ratings of 200, 400, 600 and 800 amperes, including wiring diagrams, burden accuracy charts and primary conductor data. General Electric Company.

(45) SPECIAL EQUIPMENT, coordinated process controls and panelboards are discussed in 4-page bulletin on new organization specializing in their design, engineering and building. Equipment & Controls Engineers Inc.

(46) INSPECTION EQUIPMENT, including microscopes, illuminating magnifiers, inspection lamps, micro-light kits, heavy duty miniature lamps and other inspection aids, are illustrated and described in 8-page bulletin, with specifications and application data. Arthur S. LaPine and Co.

(47) COMMUTATOR CATALOG contains 28-pages of specifications, sketches and data sheets on vertical face and horizontal and commercial ac-dc type commutators, including complete indexing of various commutators to motor manufacturers, and technical data charts. The Kirkwood Commutator Co.

(48) ELECTRICAL INSTRUMENTS are listed and illustrated on reference data sheet, covering instruments for measuring insulation resistance, ground, earth and soil resistance, high potential dielectric strength tester, volt-ohm-ammeters, current transformers and special instruments. Associated Research Inc.

(49) METALLIC RECTIFIER power conversion units are illustrated and described in 8-page bulletin, covering design, performance, circuits, applications, dimensions, ratings and weights on units rated 125 and 250 vdc, up to 300 kw. General Electric Company.

(50) RLM BOOKLET contains questions and answers about the RLM Institute, its specifications, certification procedure, tests, purposes and advantages. RLM Standards Institute.

(51) HEATING by electric blast coil heaters is the subject of 10-page catalog, with illustrated descriptions of units, construction details, specifications, magnetic contactors and applications. Industrial Engineering & Equipment Co.

(52) LUMINOUS CEILINGS as the diffuser for heating and air conditioning systems is the subject of literature covering the theory, construction and application of air-flow systems using acoustical ceilings of luminous panels to form the plenum chamber and air diffuser. Luminous Ceilings Inc.

(53) FLUORESCENT LUMINAIRES, two- and three-lamp units for surface mounting, are illustrated and described in two-color 8-page folio, with specifications, distribution curves and construction details on units with either louver or diffusing glass shielding, and luminous side panels. Gruber Lighting.

(54) CONTROL CENTERS are illustrated and described in 31-page application booklet on centralizing system controls in one group of enclosures, including the electrical components of various system control centers and a building-block plan for laying-out centers. Westinghouse Electric Corp.

(55) MASONRY DRILLS to speed anchoring or installation of machinery, equipment, ducts, apparatus, ironwork, conduit and pipe are illustrated and described with accessories in 4-page bulletin. Tilden Tool Mfg. Co.

Let IDEAL Tools Save Time and Cut Costs on Every Wiring Job..

FISH TAPE, REEL AND PULLER (Patented No. 1,890,945)

3 tools in 1—

Cuts Fishing Time in Half!

Even long conduit runs are easy to handle when you have the BIG, sure pull afforded by an IDEAL Reel and Puller. Tape is always under safe control—in the conduit or locked in the Reel—easy to reel in or pay out—can't kink or spring loose. Complete with tape of finest flat spring steel, oil tempered. Five stock sizes and lengths —50′ to 200′.

FLUR-TEST

Fluorescent Fixture Tester

Shows Source of Trouble, Right at the Fixture!

Saves time and effort in testing fluorescents. Shows in just a few seconds, right at the fixture whether failure is in the fixture circuit, the tube or the starter. Prevents needless discard of good tubes Models for 15-40 and 85-100 watt fixtures with exposed starter or with adapter for starter behind tube.

"E-Z" Wire Stripper

Strips Clean, Strips Fast and Saves on *Wire!*

The rugged, all-steel stripper that has been a stand-by of electricians for years to speed up and simplify stripping of stranded or solid wire. Easy to use as pliers. Automatic stop positively prevents crushing of stranded wire. V-notches on blades save wire by eliminating accidental scoring or cutting of wire. Portion of hardened, replaceable blade also serves as a wire cutter. Six sizes handle all wire gauges from 8 to 30.

Wire Pulling LUBRICANT

Provides a film of lubricant that speeds up wire pulling and protects insulation against strains and breaks. Makes it easier to add wires to conduit already containing wires or to remove wire from conduit. Non-corrosive, non-combustible and non-injurious to hands or clothes. For lead or plastic covered wire or cable. (Not for asbestos covered wire.) Quarts or gallons.

IDEAL WIRING TOOLS ARE SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS

IDEAL FREE CATALOG DATA

IDEAL INDUSTRIES, Inc.
1041 Park Avenue, Sycamore, Illinois

Please send catalog data on:

- ☐ Fish Tape, Reel and Puller
- ☐ "E-Z" Stripper
- ☐ Wire Pulling Lubricant
- ☐ FLUR-TEST

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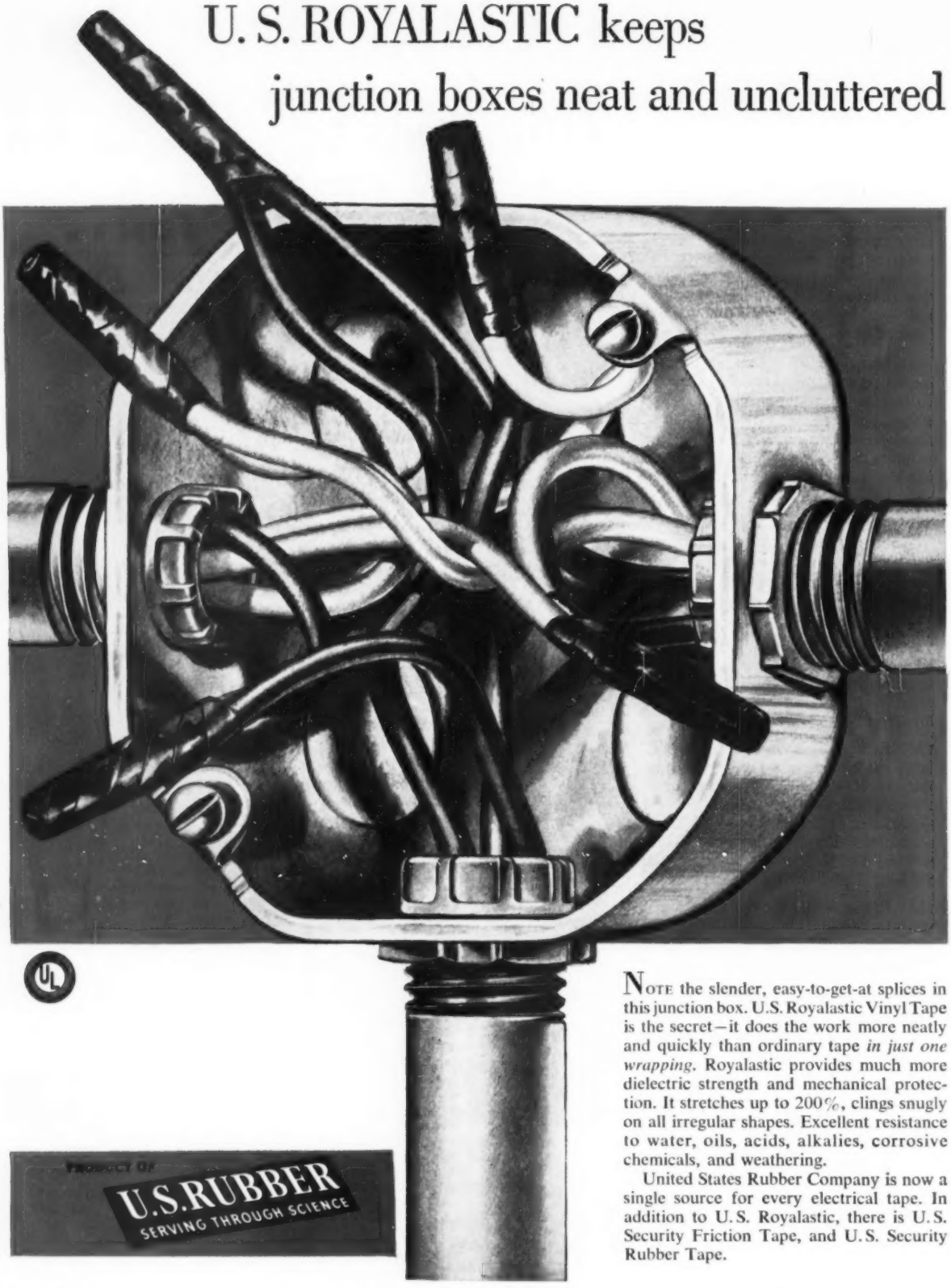
U. S. ROYALASTIC keeps junction boxes neat and uncluttered



NOTE the slender, easy-to-get-at splices in this junction box. U.S. Royalastic Vinyl Tape is the secret—it does the work more neatly and quickly than ordinary tape *in just one wrapping*. Royalastic provides much more dielectric strength and mechanical protection. It stretches up to 200%, clings snugly on all irregular shapes. Excellent resistance to water, oils, acids, alkalies, corrosive chemicals, and weathering.

United States Rubber Company is now a single source for every electrical tape. In addition to U.S. Royalastic, there is U.S. Security Friction Tape, and U.S. Security Rubber Tape.

PRODUCT OF U.S. RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

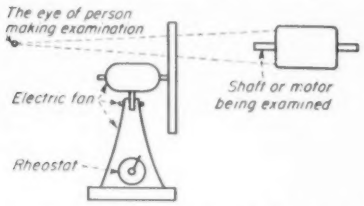
QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Stroboscope

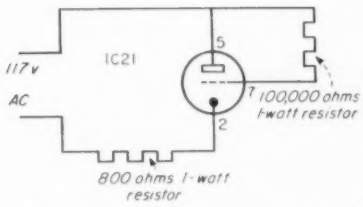
QUESTION J22—Our mechanical department has been encountering considerable trouble with gear meshing under various speeds. The master mechanic has asked me to build a "stroboscope" for checking gear in operation. Can someone give me details on building this instrument?—M.D.

ANSWER TO J22—I have a machine that works to perfection and I have used it for the past several years to check the speeds of different kinds of machinery. It is nothing more than an ordinary Robbins & Myers Universal fan for both ac and dc current. The number of the fan motor is 3000. This fan and motor is adapted to both ac and dc, and as there is a small switch on same to give three speeds I started from there. First I disconnected the three speed switch and in its place I substituted a 200 ohm rheostat with fine wire winding. By working the rheostat I can vary the speed of the motor to make it match the speed of almost any machine and by placing the motor as per diagram



I can look through the blades of the fan and see the other machine or shaft as if it was standing still or I can make it turn slow or fast and in either direction as I wish and thereby check any fault I might find. H.A.B.G.

ANSWER TO J22—Circuit of a compact, easily constructed and economical stroboscope is shown. The 1C 21 tube has a cold-cathode and provides a reasonably strong source of light for checking machinery while in operation. The tube rectifies the line voltage and during each positive half of the ac cycle gives off a pulse of light. This pulsing light will stroboscopically stop the motion of a synchronized motor that is operating in synchronism with the line frequency. Stroboscopes have many uses in electrical maintenance including: 1) Location of noisy machine parts; 2) Checking gear wear; 3) Measuring drive belt slip; 4) Checking spring actions to locate defects; 5) Checking progressive grinding operations on commutators; 6) Adjusting color register in printing; 7) Location of any faulty part causing lack of efficient performance; 8) Watching cutting operations to locate sources of faulty work; 9) Timing of any mechanical operation; 10) Testing electric clocks, time switches, timers, business time machines, generators and phonograph motors. In general any stroboscope will make it possible to observe any machine operation in slow motion while the machine is operating at high speed.—L.W.F.



Testing Selenium Rectifiers

QUESTION K22—What is the best way of testing selenium rectifiers? We have tried several ways, but many times those that check good are not satisfactory under load. Is there an easy way to repair these rectifiers in the shop?—S.R.U.

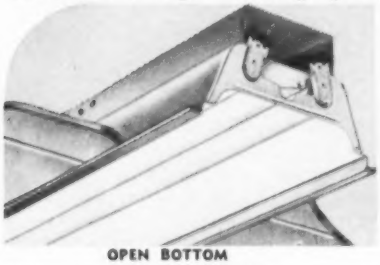
ANSWER TO K 22—Every selenium rectifier should be checked monthly for best service. Rapid check with high-range ohmmeter for dc resistance one direction; then reverse leads, which gives two resistance values. Good rectifiers will show almost infinity on one test and less than 100 ohms the other direction. Rectifier temperatures should never exceed 95 deg. F. Check for overvoltage in excess of maximum rating which can damage rectifier and overheat unit. Past overheating will be shown by small solder beads on disc undersides. Rough blemishes like blisters near pressure washers and on the selenium coatings will show places where selenium has shorted through. The "smell" test will rapidly indicate where the selenium has been damaged due to the pungent gas liberated by heated selenium. Check volt-ampere efficiency with ac wattmeter and moving coil dc voltmeter and ammeter. Efficiency should be between 65% and 85% depending on circuit. Load curve should be fairly flat from 20% to 85%. Single phase selenium units to capacitor or battery load are usually derated about 20% for high rectifier current against average current value. Aging increases rectifier resistance reducing dc voltage output from 5% to 10% depending on service. Rectifier transformers usually have taps to increase "raw" ac. Aging effect also lowers efficiency. New units connected to aged stacks may cause current and voltage unbalance because forward and inverse resistances are different. With usual rectifier rating at 95 F, at 131 F rating drops to 65%. Check for corrosive fumes which can cause trouble. In corrosive atmospheres rectifiers can be immersed in oil. Check for mechanical damage and abuse. Check for support or frame grounds. Test each terminal to ground. Excessive dirt and moisture can cause lowered resistance in stacks and short circuits. If a selenium rectifier has been idle for a long period or operated at low inverse voltage, inverse resistance decreases. When full current is applied, the inverse current will be abnormally high for several minutes until normal resistance returns. When returning to service, voltage should be applied gradually. Intermittently designed units should never be operated continuously.—L.W.F.

ANSWER TO K22—Selenium rectifiers have a destroying temperature that is between 100 and 160 degrees C. Selenium rectifiers have very little mass, and a fusetron can protect them and allow them to operate between 60,000 and 80,000 hours before the forward resistance doubles. Selenium rectifiers can be damaged by mercury vapor and external heat. They are tested by measuring the voltage drop under load, at the voltage that they have to use during normal operation. By applying correct dc voltage and current, you can see if the voltage drop in the forward direction and the leakage in the reverse direction meet your

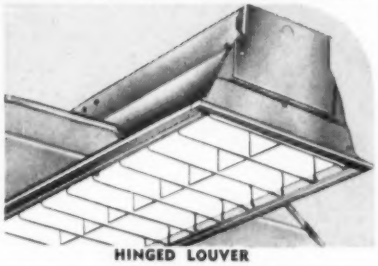
How to get *more* Troffer Lighting Business

Sell GARCY

Moderately-priced, Quality Troffers available in over 90 different units (including matching spots) for Every Lighting Application!

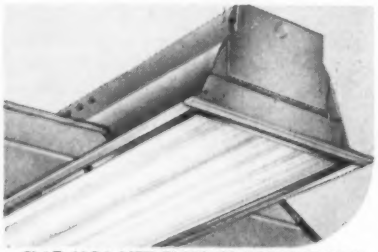


OPEN BOTTOM



HINGED LOUVER

CURVED ALBA-LITE GLASS OR CORNING LENS

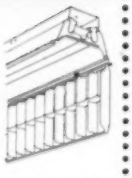


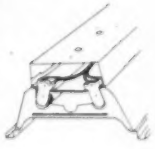
FLAT ALBA-LITE GLASS OR CORNING LENS

When you "sell Garcy", you've got what the customer wants . . . at the price he wants to pay! And there's no better way to clinch those worthwhile lighting jobs! Garcy fixtures are available in a variety to satisfy virtually every lighting requirement; special installation features enable them to go up quickly and easily; and Garcy quality assures lasting efficiency and trouble-free dependability. No matter how you figure it—the way to get *more* troffer lighting business is to *sell Garcy!*

Check these features:

Louver is punched and formed from one piece of metal. Louvers or glass frames hinge down or can be removed without tools.





Extension units (for continuous runs) have open wireway ends, simplifying wiring connections. Coupling plates provide simple, bolt-together installation and assure straight-as-a-die-alignment. Lengths of troffers are *exact* multiples of lamp lengths—fit easily into ceiling openings.

Matching square Spot-A-Lite units use Par-38 Spot or Flood Lamps. Universally adjustable. Use between or at ends of troffers in runs.

Plaster frames have openings for attaching mounting saddles, automatically aligning saddles with knockouts in tops of troffers.

Write for Catalog No. L-110

GARDEN CITY PLATING & MFG. CO.
1740 N. Ashland Ave.
Chicago 22, Illinois

approval for the job that the rectifier has to do. Concerning repairing these rectifiers in the shop I would suggest that you should get the G.E. 28 page book, No. G.E.T. 2350, called G.E. selenium rectifier stacks, and practice on damaged rectifiers.—H.S.

Measuring Secondary Current

QUESTION L22—How may the secondary current be measured in a large wound-rotor motor? For example, a 500 hp, 505 rpm, 2200 volt, 120 amps, 3 phase, 60 cycle wound rotor motor, 493 amps secondary (full load) —*W.E.T.*

ANSWER TO L22—The secondary current may be measured by using a tong test type ammeter 600 amp scale, or by using a portable current transformer 300/5 ratio and a 5 amp meter. The conventional clamp coil ammeter may also be used.—R.W.T.

ANSWER TO L22—Assuming the rotor leads are readily accessible two practical methods are available as follows: 1. Using a clamp-type ammeter of which a number are available on the market with suitable scale. 2. For greater accuracy use a split-core transformer which can also be obtained from a number of manufacturers with ratios to suit. There is no reference to the rotor voltage and care must be taken to guard against contact of the secondary leads if this voltage is high, say exceeds 250 volts.

The ads in the November issue of E.C. & M. on pages 2, 26, 232 and the 41st page of the WESCO Section, ought to, in a measure, enlighten W.E.T. as an initial informative visualization—C.O.D.

Regulating Alternators

QUESTION M22—An alternator rated at 300 amps per leg, 220 volt, 100 kw is excited by a dc generator at 115 volts and 28 amps. What would be the most practical way to regulate the ac voltage? Furnished was an ohmite rheostat to insert in the exciter field circuit, but on heavy motor starting loads, it would have to depend on the diesel drive motor to resume the original voltage, which would probably be a long, low voltage starting period.—E.H.

ANSWER TO M22—The most practical way to regulate the voltage of this generator is with a voltage regula-

New

P & S® WEATHERPROOF DUPLEX OUTLETS

For Complete Protection Install P & S 4527

Features . . .

NEW TYPE POSITIVE LATCHING CAP (see illustration) will not become loose, yet can be unlatched with an easy turn. No threads to cross or catch. Serrations on cap allow a firm grip.

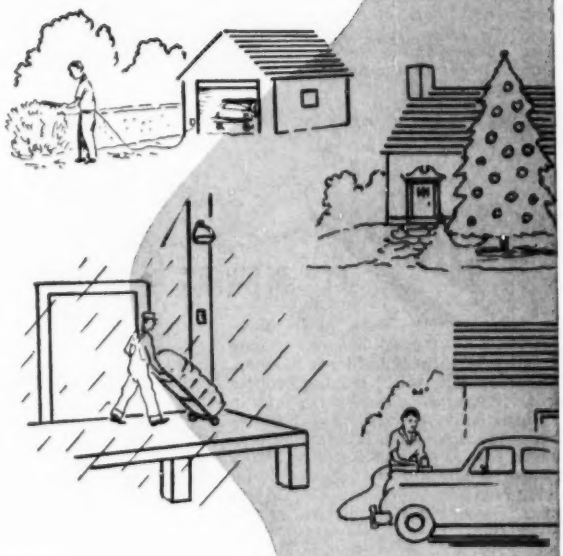
PLATE AND CAP are cast of the finest aluminum alloy, especially treated to withstand extremely severe conditions, such as imposed by Navy salt spray tests.

COMPLETE PROTECTION against the elements is insured by fine quality cover and plate gaskets.

DOUBLE GRIP OUTLET is our "13202," P&S-Despard type outlet — Meets Government Specifications.

P&S 4527 is just one device in the complete line of P&S Weatherproof Devices, featuring T-rated switches and double-grip outlets.

Specify and install these precision-built, specification type Weatherproof Devices for long-lasting, dependable service.



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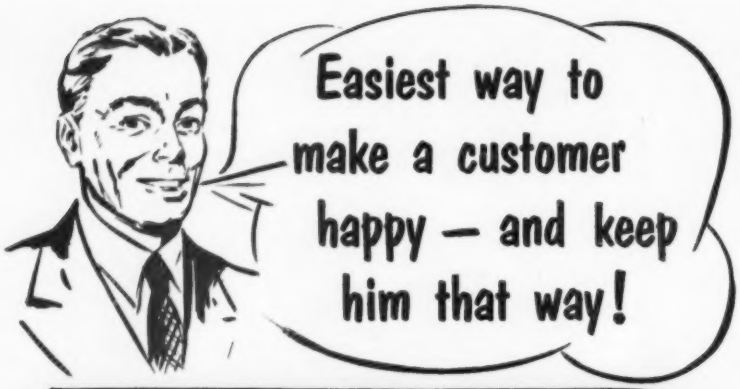


Recommend the fans that are easy to live with –

"Buffalo" BABY VENT SETS

Here's a "baby" you can install quickly almost anywhere or move from place to place for 1001 blowing or exhausting jobs — ventilation of toilet rooms, telephone booths, hard-to-reach working areas. It's rugged cast iron housing is quickly adjustable to any discharge position. The efficient multiblade rotor moves a lot of air —quietly. Like all "Buffalo" Fans, it's just about maintenance-free and everlasting. One of many proven customer-pleasers in the "Buffalo" line.

"Buffalo" "E" BLOWERS

These husky blowers - exhausters are popular for furnace and forge blowing, line boosting, tool cleaning, cupola work. Often, several of these fans in an installation are preferred over one large fan for their installation economy and operating flexibility. Why not write now for the full details on these fans that are easy to sell, easy to install — and easy to live with?

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

520 BROADWAY BUFFALO, NEW YORK

75th

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

PANEL BREEZO FANS | BELTED VENT SETS | BELT-AIR FANS

BREEZ-AIR ATTIC FANS | L BREEZO FANS | NV BREEZO FANS

tor of which there are several makes and types. It will be necessary to install a potential transformer on the generated voltage circuit. There are two vibrator types of regulators which are very inexpensive and should be satisfactory for that job. This, of course, is assuming that the diesel driver is equipped with a reasonably good governor. Generally speaking any generator, even with proper regulation, will not maintain good voltage during across-the-line starting period when motor size approaches 20% to 25% of generator capacity.—J.C.G.

ANSWER TO M22—The regulation of modern alternators is rather poor being somewhere between 35–40%. The output voltage can be accurately controlled however at all loads within reasonable prime mover speed variations by the use of a voltage regulator. A method is used to automatically and quickly adjust the generator field current which is done by adjusting the exciter output voltage. This is done by employing electrically operated switches which progressively short-circuit sections of the exciter field rheostat. These switches are operated by a relay which is operated by alternator voltage. Today we use the means of a rocking type contactor voltage regulator. Such a regulator, manufactured by any of the major companies, will take care of your problem 100%. It is not possible to do this by manually operating your field rheostat and definitely not practical. I would suggest getting a proposition from one of the suppliers—giving him complete name plate data not only of your alternator but its companion exciter.—E.A.M.

Can you ANSWER these QUESTIONS?

QUESTION W22—We had a condition on running a vertical deep well pump on a cooling tower basin that I am at a loss to explain completely. Possibly some of your readers could help me. The motor on the pump is a 100 hp 440 volt squirrel cage induction motor fed by a 200 amp circuit breaker and a conventional magnetic motor starter. The motor is started by momentary contact pushbuttons.

The motor is normally fed from the power company, but it has an automatic transfer switch that will throw the motor over on a 1000 kw diesel generator in the event of power failure. The transfer switch was manufactured by the Automatic Switch Co., 400 amp. Bul. No. 908 Serial No. B18087. It transfers automatically

from the power company to the diesel, but to transfer back to the power company a reset button must be pushed. The unit was tested by switching off the normal power which threw the pump onto the diesel. The transfer to the diesel worked smoothly, but part of the time when the transfer switch was thrown back to the power company the pump made a noise as if it was cross phased and the 200 amp. breaker feeding it was tripped out. Most of the time the transfer was fast enough in both directions that the magnetic contactor did not fall out. Also the diesel was not synchronized with the power company.

I would be interested in knowing if other places have had this type of trouble with automatic transfer switches.—O.B.T.

QUESTION X22—How can I protect a 5 hp, 3 phase, 230 volt motor that is used to drive a laundry extractor? It takes almost three minutes to bring the load up to full speed. Then the motor draws about 11 amps. The motor has to be started every ten minutes.—H.S.

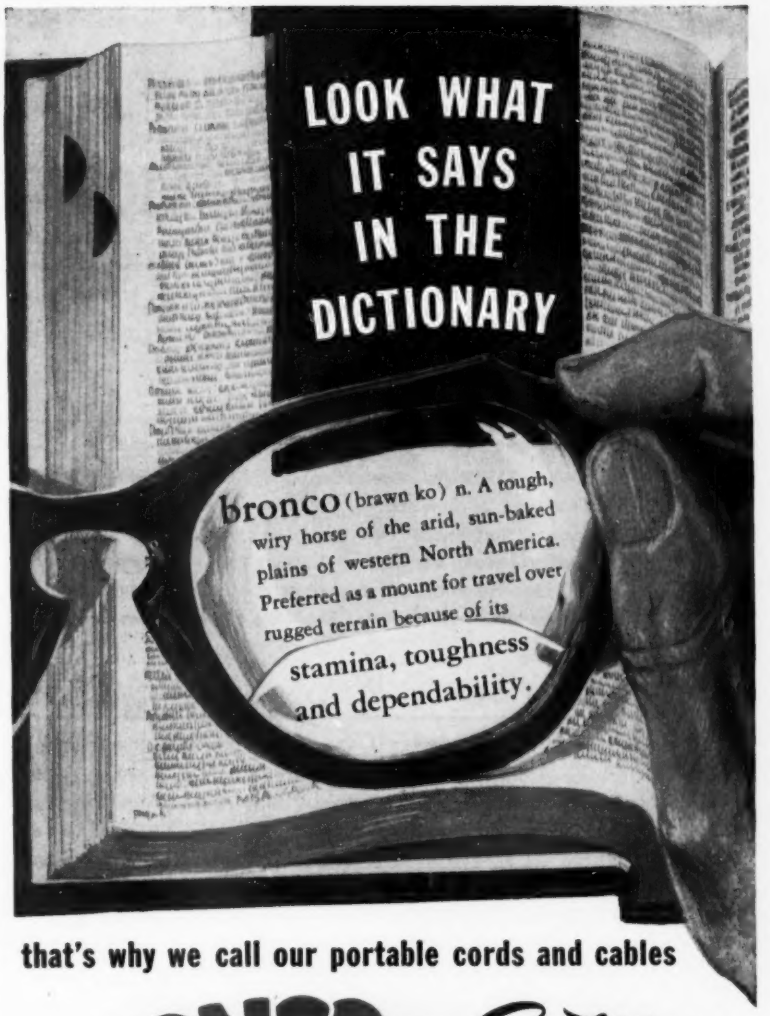
QUESTION Y22—What percent of increase in amperes could be expected in a meter as it rises in temperature? We have a 300 hp pump motor which runs normally, trouble free, until a sultry day increases the heat to the extent that the breaker opens. The thermals are for 67 amperes, full load. I increased these by adding jumpers of number 22 wire. This did not entirely eliminate the shut-downs, so forced air was used, which eliminated shut-downs.—E.S.H.

QUESTION Z22—We have several 5 hp 440 volt induction motors that have been damaged to the extent that all leads are broken off and now are unmarked. These are nine lead motors for 220/440 volt operation. How can we identify these leads without stripping the motor down?—W.P.R.

QUESTION A23—Is it possible to determine dc motor interpole polarity without removing the armature from the motor?—L.W.F.

QUESTION B23—What type of oscilloscope is best for servicing electronic circuits such as found in amplidynes, resistance welders, electric eyes and electrical polyphase circuits of 600 volts or less. It is not to be used for radio or television.—M.D.

PLEASE SEND IN YOUR ANSWER BY MARCH 15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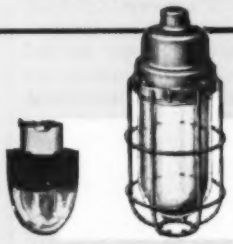

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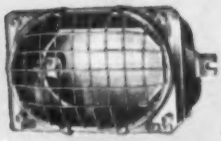

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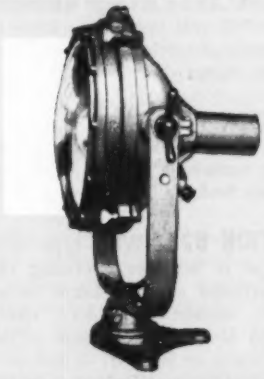

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Answered by

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
F. N. M. SQUIRES, *New York Board of Fire Underwriters, New York, N. Y.*

Emergency Lighting Circuit

Q. *Is it true that the National Electrical Code does not accept the use of a connection ahead of the main line service switch for current supply to the emergency lighting circuit in the hospital operating rooms?* —J.B.

A. You will notice a fine print note following Section 7011 which states that it is recommended hospital operating rooms be served by a separate and individual service as supply for their emergency lighting and that a connection on the supply side of the main service switch be not depended upon for such a supply. Therefore the Code does not prohibit such a connection but rather recommends that it not be used.—G.R.

Riveting Motor Control

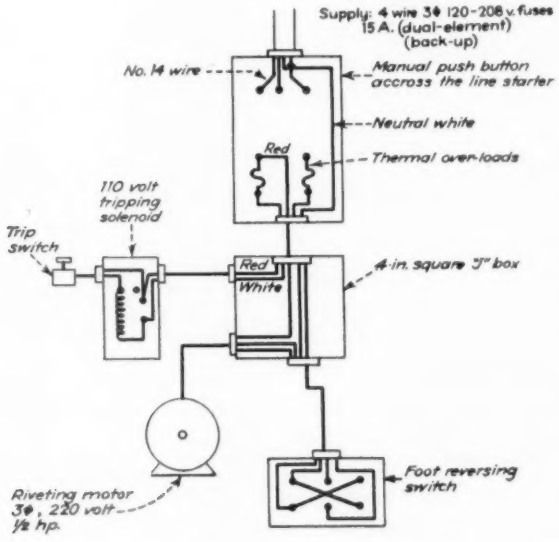
Q. *Does a Code violation exist here? If so, please point out same.*—P. P. G.

A. In view of the limited information shown on the diagram, it is impossible to make definite commitments with respect to some of the features involved with the circuit. In the absence of any definite Code question, I offer the following comments:

According to Section 4322-b a continuous duty motor of one hp or less, manually started and within sight of the starter location, is considered as protected by the overcurrent device protecting the conductors of the motor branch circuit. Since the motor shown on the diagram comes within these limitations the 15 ampere fuse protecting the branch circuit also protects the motor and it would be unnecessary, as far as the Code is concerned, to use the thermal overloads shown. This comment is not intended to discourage the use of same. I assume that the manual disconnecting means disconnects all ungrounded conductors as required by Section 4406 and also complies with Section 4402-b as to the type required.

The use of the reversing mechanism raises a point which concerns the frequency of operation and the plugging of the motor. If this duty is severe, the conductors and the motor would be subjected to the current inrushes due to both starting and plugging currents and overheating would result which could be in violation of the general requirement for conductors covered by Section 3191 and 3102. If the load involved with the 110 volt solenoid is not sufficient to influence the operation of the 15 ampere fuses, I see no Code violation. It is possible however, that this load added to the frequent reversal of the motor could result in heating sufficient to blow this size fuse. If the 4-inch square box shown on the diagram is one and one half inches deep only eleven No. 14 conductors would be permitted. The diagram shows twelve conductors and unless some of the conductors ran through the box without splice, there would be a Code violation of Section 3709.

If I have omitted comment on any other pertinent point, do not hesitate to let me know.—B. A. McD.



Conduit Couplings

Q. *We are now installing a rather large conduit job and have just been advised by the inspector that the couplings I am using have been dipped in a lacquer of some kind and that therefore they will form an insulating link between each section of conduit and cannot be used on this job. As I already have all the conduit and couplings and other fittings necessary for the entire job on hand, I will appreciate being advised as to whether or not they must be returned.*—M.T.

A. The inspector is wrong as the thread on all conduit is protected in some manner against corrosion and on many conduits this protection consists of enamel. Standards governing the construction or manufacture of conduit couplings states that a coupling shall be protected against corrosion in the same manner as required for conduit and, referring back to the section on conduit itself, we find the statement that if threads are cut after the protective coatings are applied, they shall be treated to prevent corrosion taking place before the conduit is actually installed. The Underwriters' Laboratories also require that whenever a lacquer of any type or finish other than metal plating is used to protect such threads it is necessary

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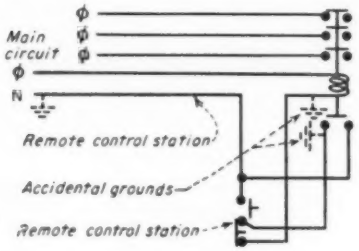
a special investigation be made of the corrosion resisting coating to be used, the idea being that it is essential it be of such type that the application of the coupling to the threaded conduit will assure both the protection of the threads against corrosion and also electrical continuity when the couplings are once properly applied to the conduit.—G.R.

Motor Control Circuits

Q. *The fine print note to Section 4373 recommends "that control circuits be so arranged that an accidental ground will not start the motor". What remote control circuit will cause the motor starting with an accidental ground in this circuit?*—C.D.R.

A. In many installations the remote control circuit for a motor controller may be energized from a different supply source. Thus a 440 volt motor may have a 440 volt controller with an 120 volt operating coil. The main contactors would be tied in to the 440 volt circuit to feed the motor terminals. A separate 120 volt wire, grounded neutral system would be utilized to feed the control station, the interlock and operating coil of the controller.



The above diagram shows the interlock and control station installed in the grounded conductor.

A study of this diagram will indicate that any accidental ground occurring on that portion of the remote control wiring in heavy lines, will tend to keep the motor running.

If the accidental ground occurs on any part of the conductor feeding from the coil to the stop button terminal of the remote control station, this ground will automatically complete the circuit to the controller coil to ground and keep it always energized.

If the accidental ground occurs in the second heavy outlined circuit wire feeding from the common "start-stop" remote control station terminal to the controller interlock terminal, the controller coil will be energized as long as the "stop button" on the remote

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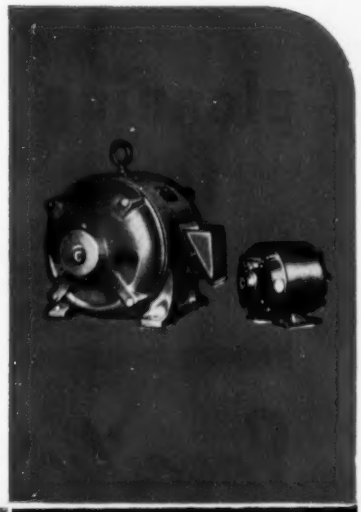

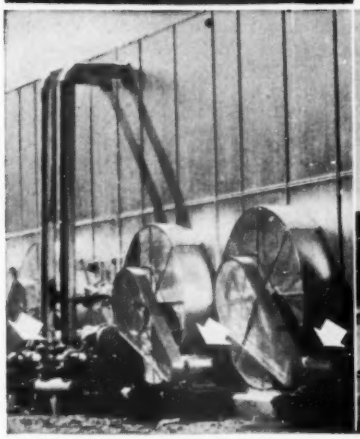

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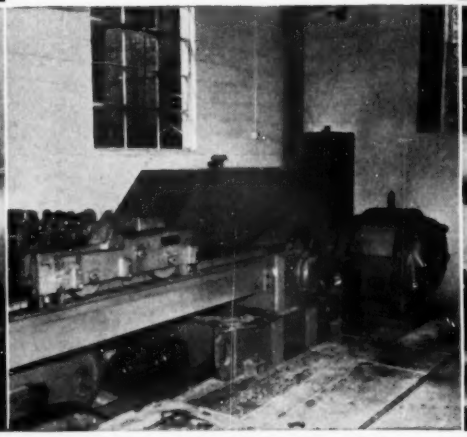
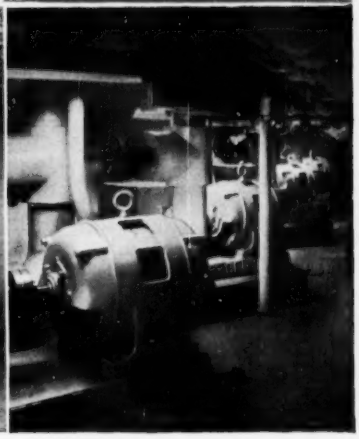
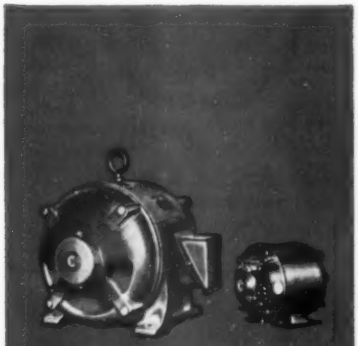


75 Horsepower Century drip proof motor on a copper tube drawing machine.



Century 125 Horsepower motors on circulating pumps for chilled water. Used in department store.



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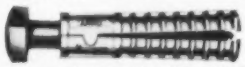

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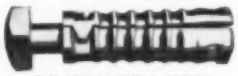
A-C-E EXPANSION SHIELD

DOUBLE EXPANSION SHIELD



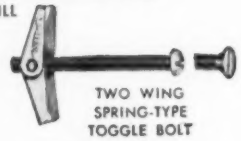
O-E EXPANSION SHIELD

MACHINE SCREW ANCHOR

STUD BOLT ANCHOR

LEAD SCREW ANCHOR

MAL-LEAD BOLT ANCHOR



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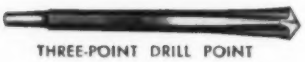

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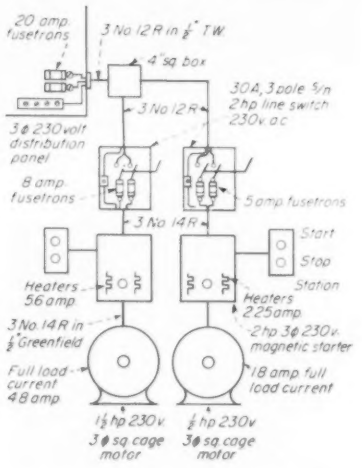
control station is in its usual normal position, i.e., closed contact position. This circuit will be de-energized each time the stop button is pushed to the open position. It will however tend to keep the motor circuit energized since normally the stop button section is a closed circuit.

Obviously the correct method to wire up this remote control conductor circuit would require the grounded neutral conductor to be connected directly to the coil. The phase line would then be in the interlock circuit and the remote control station circuit. Any accidental short in any part of the remote control circuit wiring would not cause the controller coil to be energized.

An accidental ground on the neutral would have no effect whatsoever on the general operation of this circuit. An accidental ground on the phase wire would now act to "short out" the coil entirely and thus keep the controller "open".—B.Z.S.

Motor and Feeder Protection

Q. *Does any Code violation exist on the sketch shown below? If so please point out same.*—P.P.G.


20 amp. fusetrons
3 No 12 R in ½" T.W.
4" sq. box
30A, 3 pole ½in 2hp line switch 230v. a.c
3 No 12 R
3ϕ 230 volt distribution panel
8 amp. fusetrons
5 amp fusetrons
3 No 14 R
Start
Stop
Station
Heaters 56 amp.
Heaters 2.25 amp.
3 No 14 R in ½" Greenfield
2hp 3ϕ 230v. magnetic starter
Full load current 48 amp.
18 amp full load current
1½ hp 230v 3ϕ sq. cage motor
½ hp 230v 3ϕ sq. cage motor

A. A review of the sketch indicates that we have a No. 12 feeder to which 2, 3 phase motors are connected; one is 1.5 hp and the other is .5 hp. This combination could not be recognized, under Section 4343, as a 20 ampere branch circuit since one of the motors exceed 1 hp and it could not be recognized under 4343-b unless all of the conditions specified were satisfied. As a result, Section 4362

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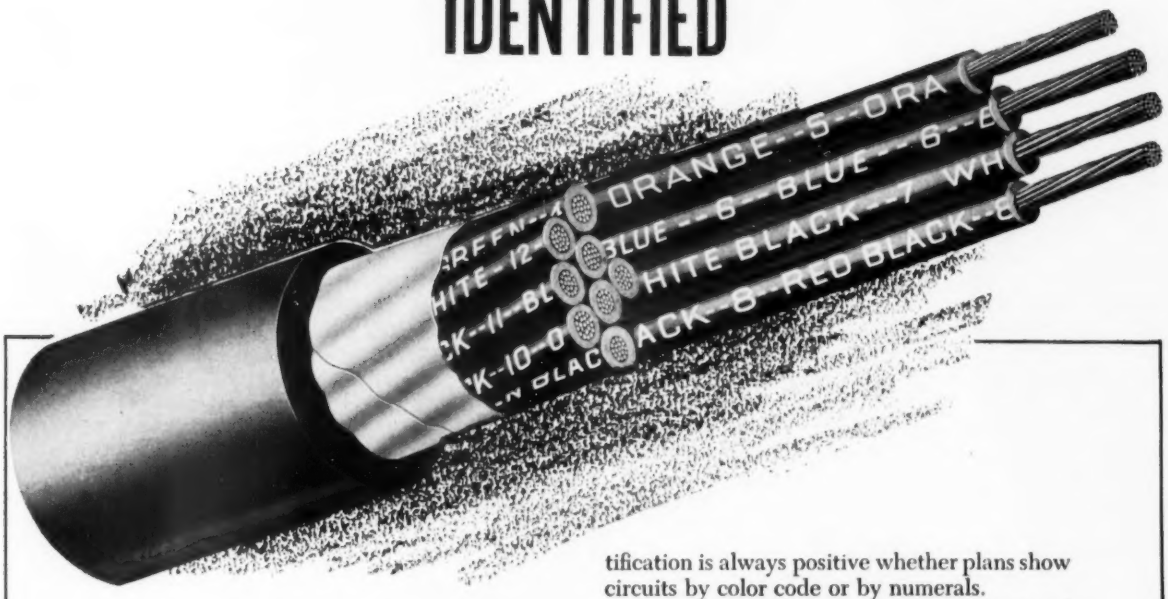

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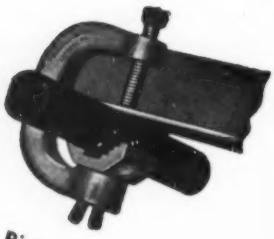

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applies to the feeder overcurrent protection and application of this rule shows that the No. 12 feeder must be protected by an overcurrent device not greater than 20 amperes which verifies the size fuse shown on your diagram. Both motors are connected to this feeder through individual branch circuits and each circuit has its own overcurrent device, disconnect and motor overcurrent device. The size of the motor-branch circuit protective device is computed in line with Section 4342 and we find the figures of 8 and 5 amperes shown on the diagram are correct. The size of the motor overcurrent device is computed in line with Section 4322-a and for 40 C motors the heaters 5.6 and 2.25 amps shown on the diagram are correct. We also note however, that the one half hp motor if it was manually started and within sight from the starter location, as covered by 4322-b, that it could be protected by the motor branch circuit overcurrent device which in this case would be 5 amperes. Since one of the phase wires is grounded, the two pole switch and fuse disconnect is standard per section 4406. The change to No. 14 wire at the disconnect is permitted since the size of the entire branch circuit could have been No. 14. I do notice however, that the grounded phase has a terminal at the distribution panel and the disconnect switches, and if this terminal is not insulated from the metallic enclosure, there is a definite violation of Code Section 2523. The two heaters shown might conflict with Section 4327. I see no other Code violations which are evident from the information given.—B.A.McD.

Conductors

Q. *I have just been told by an inspector that I should not employ the use of a triple braid weather-proof conductor as the neutral in an underground circuit carrying 115 volts. As this has been very common practice in the past, especially on street lighting circuits, and as I cannot find anything in the National Electrical Code which prohibits such practice, I am wondering if you can explain our inspector's action.*—R.K.

A. I assume you are referring to conductors buried directly in the earth, in which case the inspector is correct in asking for a special type of insulation on the neutral conductor if this conductor is located in soil in which decaying vegetation may be present. Circuits placed in dry sand beneath paving will undoubtedly have a satisfactory life where a conventional triple braid weather-proof conductor

This Stator Didn't Say NO!

LIFE OF TECOLOTE TUNNEL EQUIPMENT IS MORE THAN DOUBLED WITH SAFE-T-SEAL

The Tecolote Tunnel Project, near Santa Barbara, California, was threatened by electrical equipment failure because of excessive humidity and high temperatures. Treatment of the equipment with Safe-T-Seal saved the day. The 10 H.P., 3-phase, 220-440 volt stator illustrated is a typical example. At the end of a 7-month period, the case rusted away...but the stator, treated with SAFE-T-SEAL, *did not fail.*

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Use SAFE-T-SEAL...The Amazing New Impregnator That Offers Maximum Protection by Its "Molecutronic" Action...Now Available to Industry from Coast to Coast

Doubling the life of your electrical equipment means money in your pocket.

That's why you should investigate this revolutionary new development. It reduces down-time, prevents unnecessary work stoppages, eliminates unnecessary idle man-hours. SAFE-T-SEAL is particularly economical and profitable where *tough* operating conditions prevail.

What SAFE-T-SEAL Is. SAFE-T-SEAL is *not insulation* in the generally accepted sense. In itself, it has no appreciable dielectric strength. Operating on an entirely new principle, called "molecutronic" action, it neutralizes the effect of the "paths of least resistance" when they come in contact with a conductor processed with SAFE-T-SEAL. It is used *in addition to* normal insulating materials and varnishes, fortifying them, prolonging their life and affording protection against the destructive effects of severe operating conditions normally present in many industries.

On-the-Job Performance Shows

1. That Safe-T-Seal protects a metallic conductor coated with insulation from water and certain aqueous solutions of solids, liquids and gases;
2. That, in the presence of an atmosphere laden with water vapor, common salt, and/or certain gases, Safe-T-Seal retards the corrosion of copper and other metallic and nonmetallic materials;
3. That Safe-T-Seal penetrates the insulation material to which it is applied affording its observed effects through impregnation of the material of the conductor;
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Safe-T-Seal applied to equipment at 160° F, by immersion, low pressure spray, pouring or brushing, dries at room temperature and remains effective for long periods of time regardless of extreme temperature changes. Application may be made in your own shops, or through the facilities of your nearest Authorized Safe-T-Seal Motor Repair Shop.

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- Insulators
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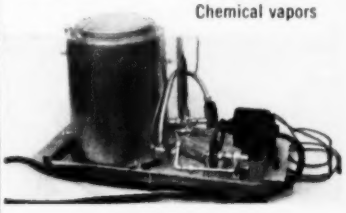
- Animal fats
- Creosote fumes
- Sulphur dust
- Sulphuric fumes
- Acid solutions
- Alkali solutions
- Conductive dusts
- Salt spray
- Chemical vapors



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The pressure-spray dispenser illustrated is available for industrial electrical maintenance departments and independent motor repair shops at nominal cost. Efficiently designed, works smoothly...saves time, man-hours. Fully portable on ball-bearing casters. Easy to use. Permits economical use of SAFE-T-SEAL...at required temperature.

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is used as the neutral. However, in soils where moisture and decaying vegetable matter may be present, it is not uncommon to have the soil sufficiently corrosive to destroy copper within a comparatively short time. Therefore, in many areas inspection authorities today are requiring that either a soil analysis be made or that the soil be considered corrosive and that a corrosion resisting type of insulation be employed on the neutral conductors. Today there are available weatherpoof wires having either a polyethylene or a neoprene jacket and some inspection authorities are accepting the use of this type of conductor for the neutral in underground circuits. In other words, they require that all ungrounded conductors be of the type approved as USE conductors and are accepting the neoprene or polyethylene jacketed weatherproof for the neutral. So far this requirement is not contained within the National Electrical Code, except that in Section 2303-b we do find the sentence which reads as follows: "Service conductors installed underground, or in concrete slabs or masonry in direct contact with earth, shall be lead-covered or of other types specially approved for the purpose." While the preceding sentence of this paragraph leads some persons to believe that the Code accepts the bare conductor in contact with the earth, it is my belief this sentence refers only to bare conductors contained within raceways which in turn are located underground. —G.R.

Service Cable Feeders

Q. *We have a question on the Code as follows: We plan to connect a 8/3 feeder cable into an existing 60 amp service entrance system supplying service to a main building to accommodate service to a small boat house on the property. Will it be possible to use type SEU cable and run through the attic 45 ft. and span 140 ft. to the boat house for an overhead run? Or would it be possible to run out of the attic to the outside of the house with 8/3 Romex cable to the basement and pick up an 8/3 Neoprene underground cable in a splice box? The Romex on the outside of the building will be protected by overhanging eaves.*—G.M.D.

A. In the absence of complete details, we must make some assumptions in answering your question. They are as follows:

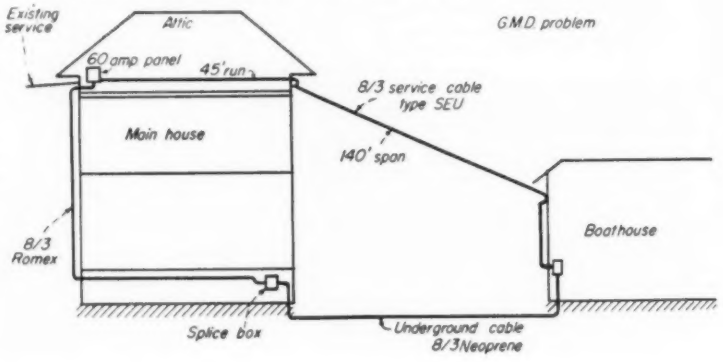
1—According to Section 2302 of the Code, the buildings in question must be under single occupancy or management. Interpretation No. 3 advises that "Common ownership is not sufficient to establish "single occupancy or management". We assume that this rule is satisfied.

2—The next question concerns the new No. 8 feeder connection at the main 60 amp service switch. Will the additional load at the boat house overload this switch? Will this new feeder be properly protected against overload at the main service?

Proposal No. 1. Assuming that no Code violation is involved with the above comments, Section 3382 of the Code recognizes any type of approved service entrance cable as a feeder for interior wiring run from a service cabinet to supply other buildings, provided the conditions stipulated in the rule are satisfied. The overhead run between buildings is also acceptable but the 140 ft. span is questionable.

Proposal No. 2. This proposal shows Romex cable run on the outside wall of the building. This is a violation of Section 3362 of the Code since this type cable may not be used exposed to the weather. The underground run between buildings is acceptable provided the cable used was a Type USE as listed and approved by Underwriters' Laboratories. If the Romex was replaced by a service cable or any other wiring method approved for outside use, there would be no violation.

This opinion covers the use of the cables shown with the assumption that other features, as mentioned, do not conflict with Code requirements.—B.A.McD.



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Entirely new in concept and design. Wide-open accessibility. Remarkably improved performance. Vastly increased operating life.

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★ *works better*
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MOTOR CONTROL
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SEE NEXT PAGE ➡

CUTLER-HAMMER ★★★ MOTOR CONTROL

The 3 Stars stand for 3 New Standards

☆ 1...An entirely new standard of easier, faster, lower-cost motor control installation. Any electrician can prove it.

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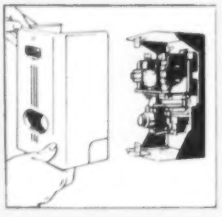
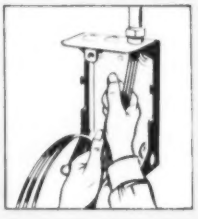
Installs easier...

Factory records everywhere today show the cost of installing motor control is usually much greater than the amount spent to buy the control equipment, often two or three times as much. Here you see why this new, better motor control actually costs less.

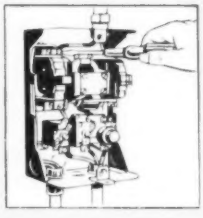
Just loosen two screws and off comes wrap-around cover. Screws stay in cover, do not fall on floor. Just loosen three screws and out comes the entire mechanism on unit plate.



Making conduit connections and pulling wires is a cinch; no starter mechanism in the way. No damaged starter parts or skinned knuckles. Wide-open accessibility, no side walls.



Easy straight-through wiring. All line terminals are at top, all load terminals at bottom. All terminals visible from front, all with solderless pressure connectors. Plenty of wiring room.



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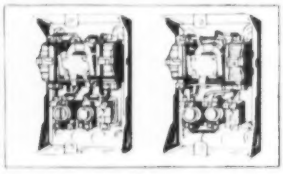
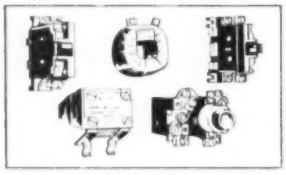
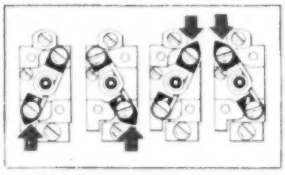
Better performance; dependably uniform operation, trouble-saving and cost-cutting more accurate overload protection. These are more than mere claims in this new Cutler-Hammer control. Field-tested over two years. Compared with every make of control by actual users...to have most say, "Better than anything we have ever used."



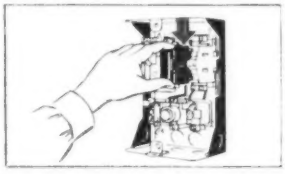
3-Coil Overload Protection. Another Cutler-Hammer "first," complete protection against single phasing as an optional feature in standard starter construction in standard enclosure.



5-Unit Construction. Just five units... magnet coil, armature, two contact blocks, and overload relay...and any unit can be removed from *front* without disturbing any other.



4-Position Overload Coils. Famous C-H Eutectic Relay now adjustable so motors can work harder *safely* without nuisance tripping. Each coil offers range of 4 ratings, selected by positioning.



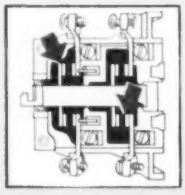
Electrical Interlocks. Interlock blocks easily added to provide up to 4 extra control circuits; normally open, normally closed, or both.

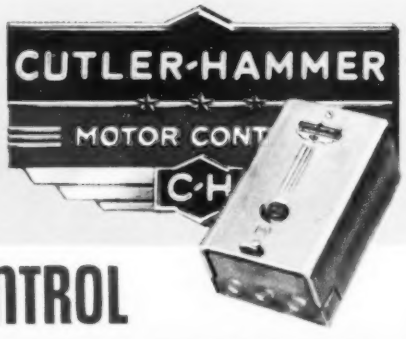
Lasts longer...

Many users will ask, "Why longer life? We have never had a Cutler-Hammer starter wear out." But there are two reasons for even longer life. First, it brings better performance to those "killer" jobs where industry expects Cutler-Hammer engineering leadership to prevail. Second, and *most* important, it decreases the *rate* of wear to the point where maintenance care and cost are virtually *eliminated* on most installations.

Armature pivoted on a rolling bearing for smooth, quiet operation. No rubbing, no sticking, no slamming. New light-weight moving parts. Less weight, less bounce; less bounce, less arcing.

New pressure-quench arc chambers. Heat of any arc rapidly expands confined air; increased pressure snuffs arc. Contacts are *vertical* dust-safe design; twin-break contacts further minimize arcing.





Cutler-Hammer, Inc.—Milwaukee 1, Wisconsin

CUTLER-HAMMER ★★★ MOTOR CONTROL

Fixture Conductor Identification

Q. *When a fixture comes wired with one white conductor and the other conductor identified by means of a colored thread in the braid, which one of these two conductors must be connected to the grounded white wire of the branch circuit?*—E.S.M.

A. Section 93101-d of the Code requires single insulated conductors of No. 6 or smaller intended for use as identified conductors of circuits, except types WP and SBW, to have an outer identification of a white or natural gray color.

Section 93101-a requires wires, cables and cords of all kinds, except weatherproof and paper insulated wire, to have a continuous distinctive marking so that their maker may be readily identified.

Section 93101-b requires identification of the type of conductor insulation in some instances.

The last two requirements for identification should not be confused with the fundamental requirement of Section 93101-d which requires all grounded conductors of a wiring system to have a white or natural gray color. This section further clarifies the matter by advising us that conductors of a white or natural gray color may also have colored tracer threads in the braid without affecting its identity as the grounded conductor and the rule further states that the live conductor of the circuit must have a finish other than and contrasting with a white or natural gray color.

In view of these Code provisions, it appears to me, in reply to your question, that the white or gray conductor should be connected to the similarily identified grounded conductor of the circuit. Since there appears to be some confusion when wires are identified, as covered by your question, it appears essential to me that the socket or lampholder connection should be checked to assure that the white or gray colored conductor is connected to the screw-shell as definitely required by Section 2008-h. —B.A. McD.

Wiring a Laundry

Q. *We have just finished the wiring of a new laundry addition to a hospital here and now we are told we must provide pilot lights for the receptacle outlets located in the room where hand irons are to be used. These pilot lights were not shown on either the blueprints or specifications and as the job was done under contract, we do not believe we should be forced to stand the expense of this additional work. Where specifications are not in conformance with Code requirements, is the contractor left holding the bag where his installation is in conformance with the specifications but not in conformance with the Code?*—K.M.

A. Your question is one which I cannot fully answer as I do not happen to know of any court actions which might have taken place to clarify this question concerning responsibility. However, I do feel it the duty of all electrical contractors to carefully check plans and specifications for Code compliance before submitting bids and when in their estimation plans and specifications do not comply with the Code, I believe it advisable to submit two bids, one in conformance with the plans and specifications and an alternate which will also conform to Code requirements with an explanation of the reasons for the two bids.

In your specific instance, Section 4236 of the Code may resolve your difficulties as I believe it quite common practice today in most instances to find irons used in laundries which are provided with integral temperature limiting devices and under this section you will note the following:

"In other than residence occupancies, each electrically-heated appliance, or group of electrically-heated appliances, intended to be applied to combustible material, shall be installed in connection with a signal unless the appliance is provided with an integral temperature-limiting device."—G.R.

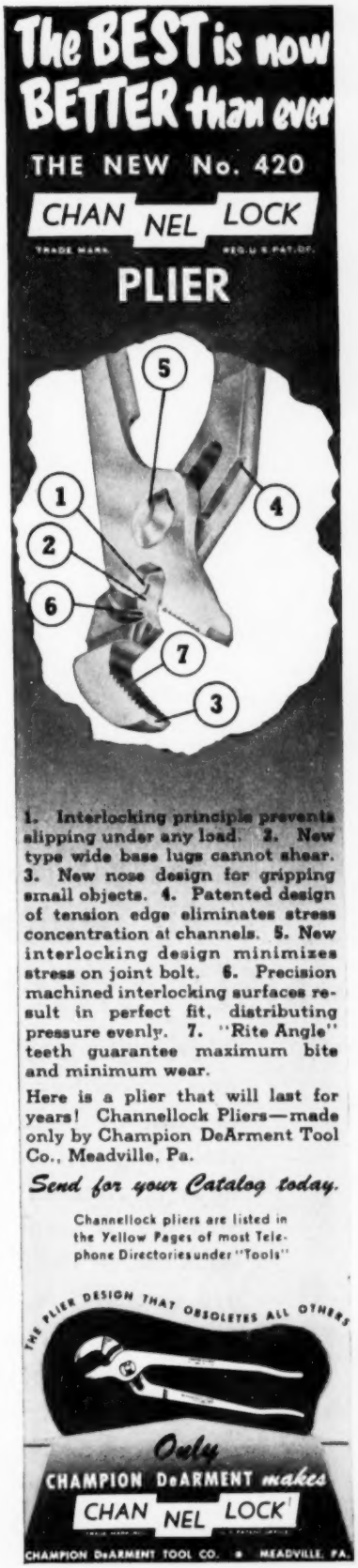
Pull Boxes

Q. *Is there any Code regulations on the length of conduit between pull boxes? If so, we are unable to find it. We are especially interested in regards to 2-inch and 2½-inch conduit.*—L.C.T.

A. In general, I do not recall any definite Code rule which restricts the length of a run of conduit between pull boxes, except for the following provisions:

Section 3471 of the Code limits the number of quarter bends in a run of conduit to four. This provision would therefore require pull boxes to be installed when more than four quarter bends are installed in a conduit run.

Section 3014 of the Code covers the support of vertical conductors in conduit and requires for various wire sizes supports at various intervals of length. This requirement definitely limits the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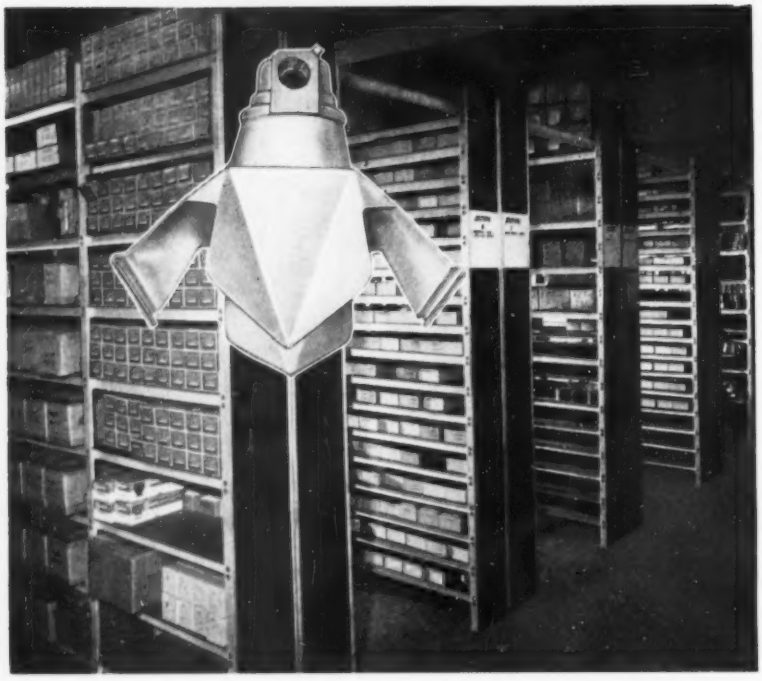

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This specialized type of lighting unit can be the means of some very profitable business. Let it work for you.

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length of a conduit run between pull or junction boxes.

The fine print note following Table No. 5 limits conduit runs containing lead covered conductors to straight runs or runs with offsets equivalent to not more than two quarter-bends. Here again pull boxes must be used when the provisions are exceeded.

The fine print note following Table No. 4 limits a service run of conduit, consisting of 3-No. 4 conductors in a one-inch conduit to 50 ft. provided not more than two-quarter bends are used and one of the conductors is a bare conductor.

I believe these are the only specific rules which concern your Code question. In all other cases, there appears to be no limit on the length of a conduit run. I believe however that usual wiring design and practical considerations limit such runs to reasonable lengths.—B.A. McD.

Motor Branch Circuits

Q. *Relating to B. A. McD's answer to "Motor Branch Circuit" question (page 283, July issue) would not the chief Code violation be that the 15-amp. fuse would not offer the proper protection for the thermal overload heaters as required by Sec. 4330?*—C.V.J.

A. A review of the question under discussion shows three, three phase fractional hp motors connected to a 15 amp branch circuit. One motor has a full load current of 1.2 amps and the other two .8 amps each. The voltage is 230. Section 4343-A of the Code recognizes such a combination of motors connected to and protected by a 15 ampere branch circuit with no separate running protection for each motor provided they are manually started as covered by 4322-b. The point which you have raised, concerning Section 4330, is well taken. This rule requires Thermal Cutouts, used for motor running protection, to be protected by fuses or circuit breakers with ratings not over four times the rating of the motor for which they are designed unless approved for group installation. Rule 4343-b also enters the picture and unless the controllers and the heaters were approved for group installation, there appears to be a Code violation.

There is, in my opinion, a question regarding the intent of the Code in the case under discussion. In this case, the motors which are manually started are considered as properly protected by a 15 amp fuse and no other protection is required. If, however, additional protection is added by the

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- *Self-contained, removable pole units of exclusive arc-quenching and heat dissipating design assure quick-break and withstand heavy shorts.*
- *Rugged handle has releasable interlock, and is designed to take three padlocks.*
- *Complete safety against accidental contacts. No live parts exposed when switch is off and door is open.*
- *Ample wiring space, easily removable interior unit.*
- *Underwriters' Laboratories, Inc. listed.*
- *Available in 30, 60, 100 and 200 ampere ratings; fusible and no fuse.*
- *Meets NEMA Type A and 1A Standards.*
- *Convenient concentric knockouts.*

Concentric Knockouts — Convenient, Cost Saving

Concentric knockouts, permit accurate location of conduit entrances for easier, faster installation. They permit maximum standardization in manufacturing and minimum distributor stocking, thus contributing to lower prices.

This standardization also helps the distributor to give you prompt delivery in accordance with your specifications.

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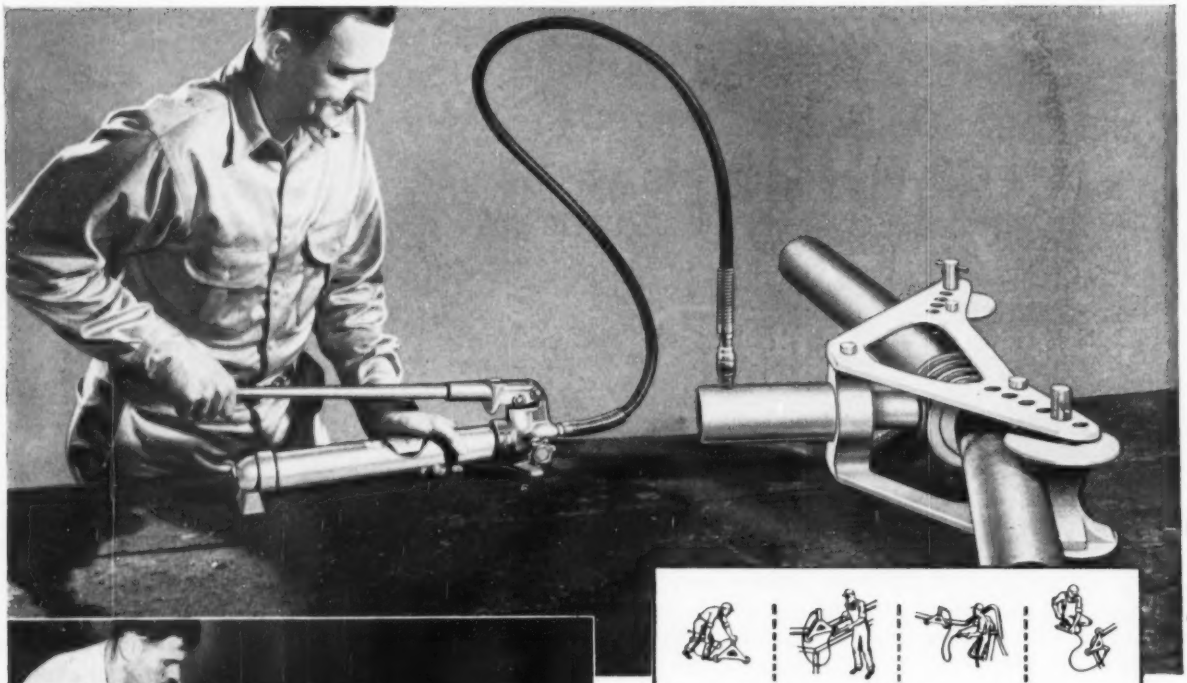
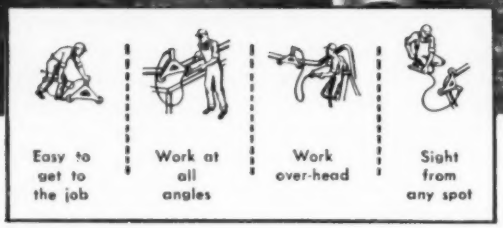
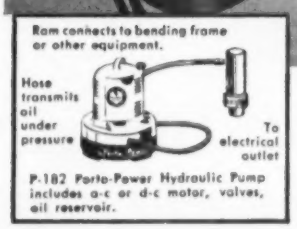
Blackhawk Hydraulic ease, speed and







P-182 Porto-Power Hydraulic Pump includes a-c or d-c motor, valves, oil reservoir.

These BENDERS are just plain handier and really portable

There's a *tremendous difference* in pipe benders and the big differences are caused mainly by the design of the hydraulic unit! With a Blackhawk "Porto-Power" Bender, you're not stuck with having to pump from one spot. The hydraulic pump is *separated* from the ram by a flexible safety hose . . . allowing the operator to stand *anywhere.*

The Bender works in any position — on its side or upright . . . on table or floor . . . on existing runs. A man can move around, "jockey" the pipe with one hand — sight along it if necessary . . . without stopping the pumping. You can get Blackhawk Benders to handle all popular sizes of conduit — rigid and thin-wall.

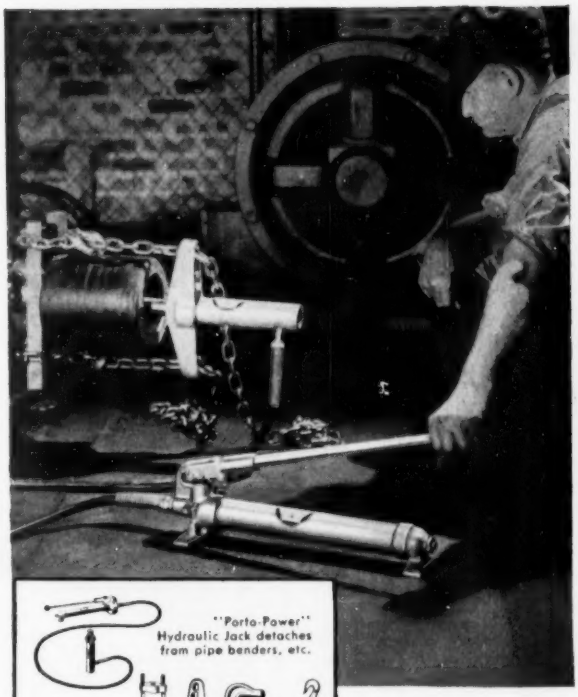
ELIMINATES HAND PUMPING!

Blackhawk's low-cost, motor-driven, portable P-182 pump can replace a hand pump on benders or other hydraulic equipment. It cuts manual effort, *triples* output. Especially effective for repetitive bends or heavy pipe. Users report labor costs less than 25% of charge for "factory bending."

Tools bring spectacular profit to electricians

DRIVE KNOCK-OUT PUNCHES THIS *HYDRAULIC* WAY!

Look! No wrench to swing. No knuckle busting. No more distorted boxes. Now the amazing "Porto-Power" hydraulic jack also drives knock-out punches. It's 60% faster! Conduit openings are *neat* — workmen are happier, safer — dies last up to six times longer! Low-cost kits.



PULL PULLEYS, LIFT MACHINERY, LICK 1001 JOBS

The same "Porto-Power" hydraulic jacks that serve Blackhawk Electrician's Equipment lick dozens of allied jobs. "Porto-Power" wipes out scores of time-wasting construction and maintenance methods. And, it's another big reason why electricians get much more for their money when they buy *Blackhawk* Benders and Knock-Out Punch kits.

Speed-minded contractors and crews are changing to BLACKHAWK

Contractors discover that men are happier when they have Blackhawk Hydraulic Equipment. It's no secret that crews who have choice of all types of benders, prefer Blackhawk. Workmanship is better, too. One good job can more than pay for *any one* of these Blackhawk Hydraulic Tools. Sold by leading Industrial Supply Distributors and Electrical Wholesalers.

BLACKHAWK®
HYDRAULIC TOOLS • HAND TOOLS

CLIP THIS COUPON
for free folder on these remarkable Hydraulic Tools!

BLACKHAWK MFG. CO.
Dept. P-2023, Milwaukee 1, Wis.

Please send me free 50B folder on Blackhawk Electrician's Equipment.

Name.....

Firm.....

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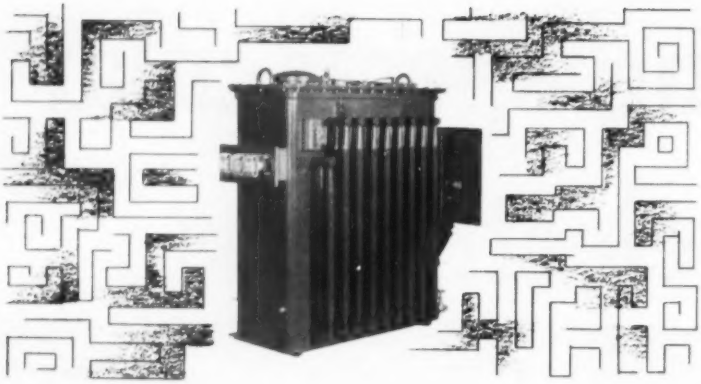


Let Standard Engineers untangle your transformer problems....

IT'S NOT EASY to arrive at the solution to a particularly difficult transformer problem. However, when you have the able assistance of experienced STANDARD engineers the solution becomes easier and complete. Don't wrestle with your transformer problem any longer. Call STANDARD today!

Standard

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

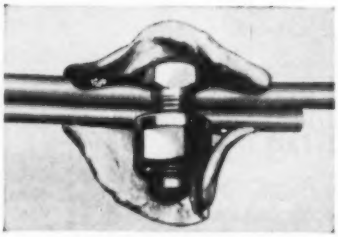
KEARNEY AIRSEAL

the MODERN WAY TO SEAL ELECTRICAL CONNECTIONS

AIRSEAL applied over a connector

Kearney AIRSEAL is a pliable high-dielectric compound for use on all electrical connections. It seals out corrosion and oxidation and maintains electrical efficiency and eliminates over-heating at joints.

AIRSEAL is easier to apply and much more effective than electrician's tape. Because it is chemically inert, it will not harden or deteriorate — forms a permanent seal.



Secure sealing of connectors is accomplished readily because of the pliability of *AIRSEAL*. Application is made by kneading the compound over the connector.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue, St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

installation of heaters, do all of the rules for such an installation apply? If such additional protection is given, must we comply with practically all of the requirements for automatic motors? My experience with 15 amp protection for fractional hp motors, 6 amps or less in size, indicate that such protection is not sufficient in all cases to prevent motor burn outs. It therefore follows that when the Code distinguishes between the hazard of an automatic compared with a manual control motor and does not require running protection for the manual motor, when 1 hp or less, it is reasonable to assume that similar recognition is intended for heaters if used. This is an opinion, which to me appears logical.

This question was briefly discussed last year at the Southern Section meeting of the IAEI and a proposal was made to add the following to Section 4330, "Provided however that any thermal cut-out, thermal relay, or other similar device for motor running protection shall be considered as properly protected by a 15 ampere branch circuit overcurrent device". The proposal was referred back to the Panel for further study. I mention this action to show that the question you have raised is controversial when very small motors are used.

As a result of the foregoing, I agree with your contention that unless the starters and the heaters used with the motors in question were approved for group installation and, the thermal cut-outs were not capable of opening short-circuits, there would be Code violation of Section 4330. I also believe however, for the reasons above stated, that the case in question was not anticipated when the rule was made and that the matter should be clarified in the Code. I am assuming that the term "approved" as used above means U. L. approval, otherwise the question of right or wrong rests with the Inspector.—B.A.McD.

OFFICIAL N.E.C. INTERPRETATIONS

INTERPRETATION NO. 388
(Issued December 15, 1952)

CHAPTER 10, Table 9.—Allowable Fill of Conductors in Conduit.

Question: Is it the intent of the fine print note following Table 9 of the 1951 edition of the National Electrical Code to limit the installation of more than nine conductors in a single conduit to a single motor and its controller, or would more than nine conductors be permitted in a single conduit between several motors and their controllers?

Answer: The intent is to limit the exception to a single motor and its controller.

BIDDLE
Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

WHERE EXPLOSION HAZARDS EXIST
MAKE PRECAUTIONARY CONDUCTIVITY TESTS
with the MIDGET MEGGER® FLOOR TESTER KIT

In dust filled rooms or where inflammable gas accumulates there is danger of explosion. One of the most insidious causes is the presence of static electricity. The average hospital anesthetizing area is a typically vulnerable example.

The Midget Megger Floor Tester Kit was developed especially for testing the conductivity of floors and equipment in areas where explosion hazards exist. This kit is offered for use in compliance with that portion of the National Fire Protection Association's Bulletin NFPA #56, "Recommended Safe Practice for Hospital Operating Rooms", for tests to determine whether the resistances are within safe limits.

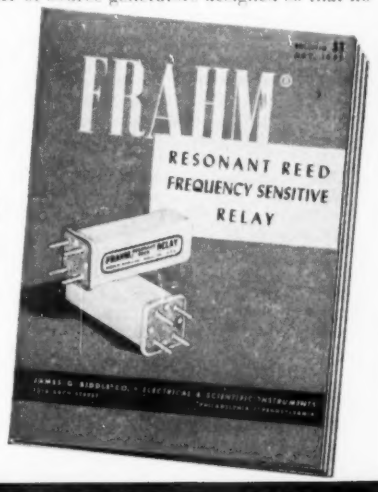
We invite your correspondence on problems of static electricity and explosion hazards. Send also for **BULLETIN 21-752-EC.**

FRAHM® FREQUENCY SENSITIVE RELAYS
Resonant Reed Design Simplifies Transmission of a Number of Control Signals Over a Single Circuit

Each carbon-steel or alloy reed is tuned to vibrate to a signal frequency within a narrow range. Several Frahm Resonant Reed Relays may be operated simultaneously on a single control circuit by employing an equal number of source generators designed so that no operating frequencies overlap. In the 200-500 cycle range 16 channels can be used on one circuit without interference. Frahm Relays may be used with all types of communication circuits including radio and carrier systems as well as wire circuits.

When proper signal is applied, Frahm Relay responds after a few cycles by closing its contacts for a fraction of each cycle. Auxiliary relay may be used for steady closed contact. Specials are available. Frahm Relays are built with nominal frequencies between 50 and 500 cycles; may be operated at any level between 20 and 200 ampere-turns.

Your correspondence is invited. For detailed characteristics, ratings, etc. of Frahm Relays send for **BULLETIN 33-EC.**



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FOR RELIABLE LOW RESISTANCE MEASUREMENTS
Select One or More of These MEGGER® INSTRUMENTS

1. Midget Megger Circuit Testing Ohmmeter—measures down to .1 ohm. Battery supply.
2. Bridge-Meg Resistance Tester—Measures down to .01 ohm. Hand generator operated.
3. Megger Low Resistance Ohmmeter—measures down to .000010 and .000100 ohms. Either battery or rectifier operated.
4. Ducter® Low Resistance Ohmmeter—measures down to .000001 ohm. Battery or rectifier operated.

All these instruments are portable, rugged field instruments that give long, trouble-free service. They are simple to use and, of course, embody the utmost reliability that is always associated with the Megger trade name. For checking circuit continuity, measuring the resistance of switch contacts in microhms—for laboratory, production line, or out-in-field trouble-shooting. Every electrical man should have one or more of these Megger instruments available. Send for **BULLETIN 24PI-EC.**

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Please send me material checked:

☐ 21-752-EC ☐ 33-EC ☐ 24PI-EC

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JOB FUNCTION

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Custom Built
Dry-Type Transformers *and*
D.C. Saturable Reactors

Engineered by SORGEL to meet your requirements

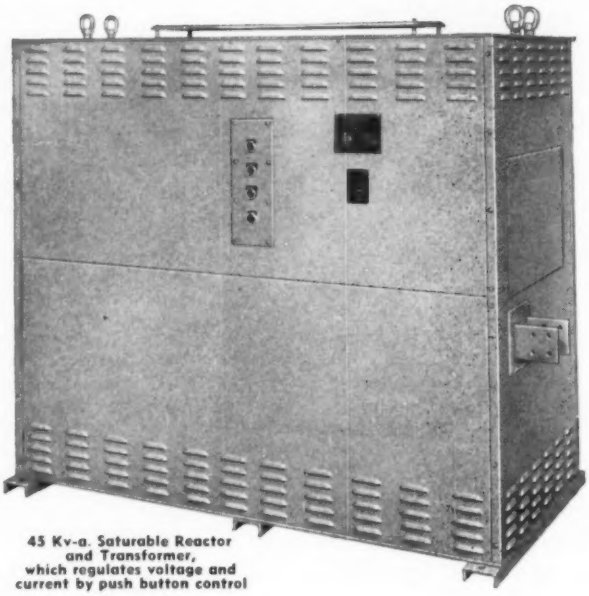
Our experienced engineering staff, expert craftsmanship, and complete manufacturing facilities, enable us to develop that degree of perfection in our product which is so much appreciated by discriminating engineers and contractors.

D.C. Saturable Reactors

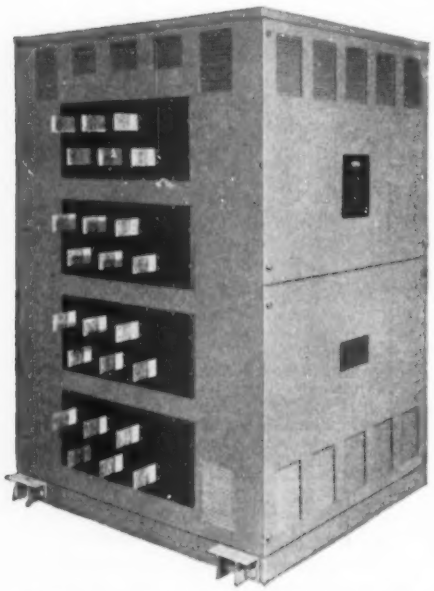
10 to 500 Kv-a. single phase.
30 to 1500 Kv-a. poly-phase.
All voltages up to 5000 volts.

Dry-Type Transformers

¼ to 1000 Kv-a. single phase.
1 to 3000 Kv-a. poly-phase.
All voltages up to 15,000 volts.



45 Kv-a. Saturable Reactor and Transformer, which regulates voltage and current by push button control



1000 Kv-a. 4160 volt Special Testing Transformer, with low voltage multiple secondaries.

If you will let us know what your requirements are we will submit our recommendations and helpful information.

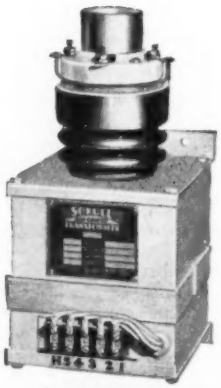
Also a complete line of

Standard Air-Cooled Dry-Type Transformers

¼ to 3000 Kv-a.
All voltages up to 15 KV.

Unit Substations

Complete with switchgear



Special Electronic Transformer

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled Dry-Type Transformers—Over 35 years

Practical Methods

HYDROHOE can be used as drag shovel, clamshell or crane; can be used for depths of 12½-feet and reaches up to 23 feet; is used by electrical contractors for trenching, cable laying, erecting switchgear and substations, excavating transformer pits and positioning light poles.

Drag Shovel Speeds Trenching for Underground Cable

INSTALLATION

Contractors faced with the necessity for trenching in connection with highway or airport lighting, laying underground distribution lines in large-area plants or performing widely-scattered short-term excavation work should be interested in a completely hydraulic truck-mounted drag shovel which includes precision control and facilities for converting the unit to a clamshell or field crane.

Force for the machine's primary digging action is applied by a hydraulic ram located between the boom and the dipper handle. A second, separate and distinct digging motion comes from the telescoping of the boom. By hydraulically extending and retracting the boom, the operator can make a level, scallop-free cut, or can dig across pipe or buried cable, or dig in front of or behind boulders to permit rolling them free—all without moving the machine from its initial position.

The truck is capable of traveling at speeds up to 50 mph on open highways, making it particularly useful for contractors working on widely-scattered jobs. With travel time between jobs reduced, the contractor can increase output on digging conduit trenches, excavating transformer pits, installing foundation footings or performing other specialized digging.

By converting the unit into a crane or clamshell, the assembly can be advantageously used for erecting substations, setting transformers and outdoor switchgear, positioning light poles and street lamps, laying cable or handling jobs involving general lifting, setting or hauling.

The inclusion of a hydraulic ejector in the dipper assembly makes it possible to push the load from the bucket without the customary jerking motion of the conventional digger. Buckets of either 18- or 12-inch span are interchangeably used.

The truck unit, manufactured by the Bucyrus-Erie Company of South Milwaukee, has a maximum reach of 23 feet, and effective depth of 12.5-feet, and has facilities for furnishing power to hydraulic pumps through a power take-off.

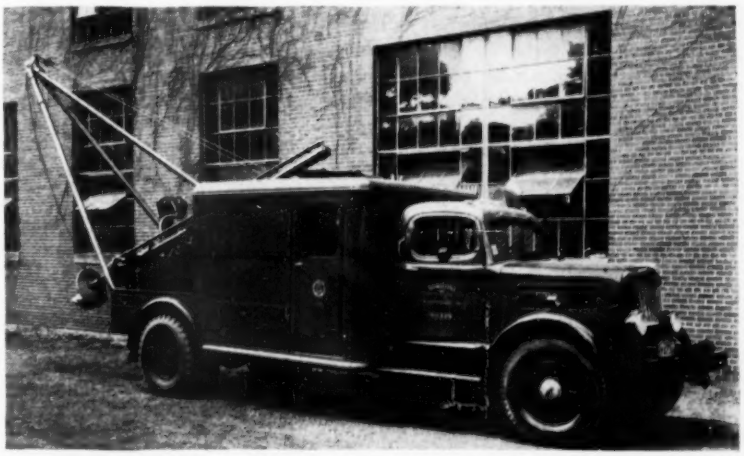
Heavy Duty Truck Carries Pole Digging Rig

INSTALLATION

New efficiency in mobile digging equipment is obtained by the Sordoni Construction Company of Wilkes-Barre, Pa., through the adoption of a heavy duty truck fitted with a boring machine, derrick and winch. The truck, a White Super Power model with 196-inch wheelbase, 2-speed axle and 5-speed transmission, has a cab equipped with hot-water heater, clothing compartments and adequate facilities for carrying auxiliary equipment and tools.

The derrick used is capable of setting poles with lengths up to 65 feet. It measures 22 feet in extended position, is of tripod construction, and is operated by a double drum winch having a 6-ton capacity. For pulling wires and cables, the derrick is also equipped with a single-drum winch having a 2-speed-forward 1-speed-reverse front mount. The hydraulic earth-boring machine has a 15-foot digging shaft, a 30-inch diameter auger blade and adjustments for drilling angular holes having pitches up to 45 degrees in either direction. A power take-off from the truck motor is used to activate this machine.

The truck-mounted hydraulic earth-boring machine adds speed, ease and accuracy to digging operations for line construction work. This truck assembly is particularly useful on pulling cables through underground ducts, especially where a number of runs are made.



NEW TYPE DIGGER for line construction work is mounted to the chassis of a heavy duty truck fitted with derrick which can also be used for pulling cable. Winch has 6-ton capacity while derrick in extended position is capable of handling poles up to 65 feet in length.

"... THE SHOPS THAT ARE PROGRESSING ARE THE ONES WHO HAVE FOLLOWED THE TREND TO CLASS H INSULATION."

MR. C. H. MacAULEY
THE HUSE-LIBERTY MICA COMPANY
Boston, Massachusetts

IN A LETTER recently addressed to New England rewind shops, Mr. MacAuley points to his company's 113th anniversary as proof of the survival value of anticipating new trends in business. He says:

"We can see a big change coming in many insulating materials, but the one that is foremost in our minds today is Class H insulation; and, when we think of Class H, we think of Dow Corning Corporation, the pioneers of silicones.

"Are you taking advantage of what they have to offer? If not, you are throwing away some excellent profit.

"As distributors, we are in a rather interesting position: — we can tell pretty well the shops that are making money; and, believe us, the shops that are progressing are the ones who have followed the trend to Class H insulation. We have one shop in the New England area that has really gone after this business, and today 40% of their billings are on Class H rewinds. Don't wait until your customer goes elsewhere before you get into Class H — it may be too late!"

We reprint these pararaphs from Mr. MacAuley's letter because they confirm our own experience with the rewind shops that have made Class H insulation available to old and new customers in all parts of the country. We are doing all we can to help them develop the rapidly expanding market for this new class of insulation. It makes hard working motors last 10 to 100 times as long as they ever did before; increases output by as much as 50%; expands business and profits for the progressive rewind shops.

Dow Corning Silicones Build Rewind Business!

Write Today

for our new booklet on the performance of thousands of industrial motors built or rebuilt with Silicone (Class H) insulation. Address Dept. CG-2.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN
ATLANTA • CHICAGO • CLEVELAND • DALLAS
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DOW CORNING SILICONES

TURNTABLE permits the soldering of ten diffraction units progressively, installing one part of each unit before proceeding to the next part. Time and proficiency are improved through this assembly procedure.

Turntable Facilitates Assembly of X-ray Instruments

ASSEMBLY

Time is saved and accuracy is increased by performing several similar production steps repetitiously, according to Charles Nostrand, Research & Control Instruments Division, North American Philips Co., Inc., Mount Vernon, N. Y. This conclusion is verified by Mr. Nostrand's use of a turntable which permits him to assemble ten identical electronic units at a time. By soldering a group of similar small parts at one time, then proceeding to the next step for each of several assemblies, he finds that proficiency is greater than it was when soldering one complicated tube socket completely, then proceeding to the next. Instead of completing an assembly progressively, he installs ten resistors, then ten similar connections, etc. It is the fundamental theory of mass production practically applied on a small scale.

Heating Cable At Sand Plant

EQUIPMENT

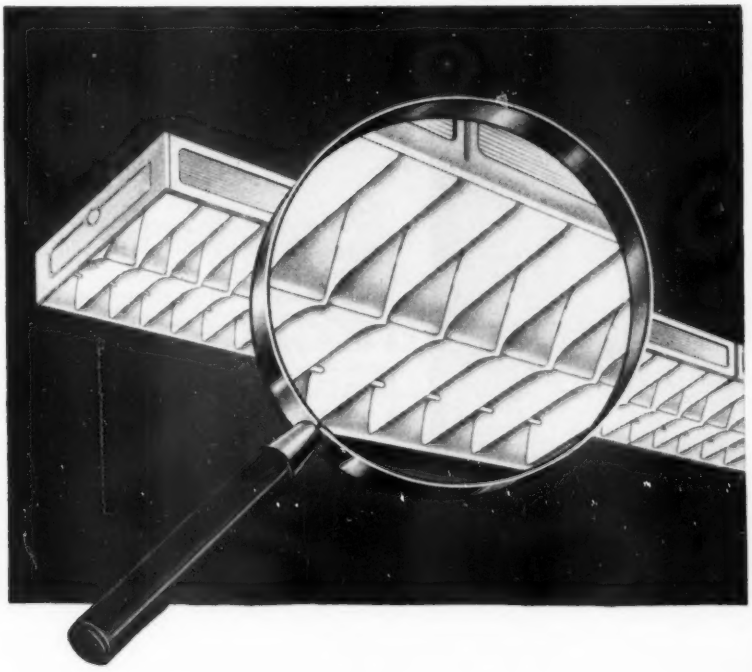
A special arrangement of lead-covered heating cable is used to prevent sand from freezing in the discharge pipes of dewatering towers at the George F. Pettinos Company's sand plant, Manumuskin, N. J.

Sixty-foot lengths of General Electric heating cable were installed in a specially-designed sheet metal form which was fitted over the two 2-inch discharge pipes and a section of the

Day-Brite "Close-up" Quality

MAKES YOUR PROFITS SAFE

because it makes satisfied customers



THIS IS A CLOSE-UP of the *interlocking louver* feature of Day-Brite's PLEXOLINE® fixtures. Each cross-wise louver is firmly locked into the center "V" louver and is tied at both ends by a steel rod. The whole shielding unit is rigid. It won't sag. It won't rattle. Louvers will not twist or bend out of shape during installation or when the fixture is being cleaned or relamped.

THIS "CLOSE-UP" QUALITY FEATURE is important to you because it helps make installation easier, faster and more profitable. It means *safer profits* through elimination of costly, time-consuming "call-backs."

310

DAY-BRITE BUSINESS IS PROFITABLE BUSINESS

Day-Brite is a contractor's line—designed and built to cut installation time and help you make more money. When you specify and install Day-Brite you *keep* those bigger profits, too. Day-Brite makes satisfied, enthusiastic customers—the kind that recommend you to other prospects instead of haunting you with profit-robbing "call-backs."

YOU'LL FIND THE DAY-BRITE REPRESENTATIVE IN YOUR AREA HELPFUL AND COOPERATIVE

There are Day-Brite representatives in 45 cities across the nation. If you're not already acquainted with your nearest Day-Brite representative write today for his name and address. You'll find him an experienced, competent lighting man and he has information that can make your business better.

* * *

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures

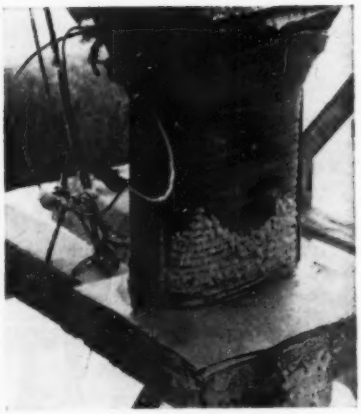
Develop an "X-ray" eye—

"AMPROBE" IT!

Now you can diagnose trouble calls at a glance, without shutting down equipment or making ammeter connections. Just snap the Amprobe around one conductor (insulated or uninsulated) and you have an accurate current reading. Walk in with this pocket-size snap-around volt-ammeter, and "you're the doctor." Write for Catalog.

Dept. ECM 23, Pyramid Instrument Corp., Lynbrook, N. Y.
(Export Div.: 458 Broadway, N. Y. 13.)

Amprobe "300" 0-6/15/30/60/150/300 amps A-C. 0-150/300/600 volts A-C. Complete with cowhide case and voltage test leads: $49.50. Amprobe "600" (to 600 amps A-C) $59.50 complete. Amprobe "1200" (to 1200 amps A-C) $67.50 complete.



HEATING CABLE in a specially designed protective and insulating jacket is used to keep sand from freezing in the discharge pipes of dewatering towers at a sand plant.

lower part of the tank. When the temperature falls below 28°, an operator has only to throw a switch to keep the sand from freezing and clogging up the pipes. Prior to the installation of the heating cable, it was necessary for a mechanic to go up on the 50-foot high dewatering towers and use a heavy-duty blow torch to keep the pipes from clogging due to freezing sand. As a remedy for the inconvenience and danger involved in this old method, the heating cable was installed.

Before the heating element was installed, it was given a protective weatherproofing with a coat of cork granules in a mastic insulating material. This coating also serves to retard heat loss to the surrounding cold air. Control of the heaters is manual. A switch at the classifier control board permits the operator to turn on the heaters at each dewatering tower when the temperature demands. In use, the heating cable has been able to keep the pipes clear at temperatures well below zero.

Simple Door Interlock For Welder Control Panel

—SAFETY

Electrical safety is one item in which the manufacturing engineering department of the Ford Motor Company is vitally interested. That is one reason why Company representatives helped in the development of the JIC (Joint Industry Conference) Electrical Standards for machine tools and other production equipment. Greater operator safety leads to better workmanship, better employer-employee relations and shorter down time due to accidents and equipment failure. The net result is increased production of

We can learn from bankrupt Micawber

"MY advice, Copperfield, you know. Annual income twenty pounds, annual expenditure nineteen-nineteen-six, result happiness. Annual income twenty pounds, annual expenditure twenty-ought-six, result misery. The blossom is blighted, the leaf is withered—in short you are forever floored. As I am!"

This is probably the most famous financial counsel in all English literature, offered a hundred years ago by Charles Dickens' character the bankrupt Micawber to the hero David Copperfield. As advice it is just as good in 1953 as it was in 1849, and just as sound for a nation as for an individual.

In 17 of the last 20 years, Uncle Sam has followed Micawber's practice, not his advice. Our national balance sheet has been, figuratively, "annual income twenty pounds, annual expenditure twenty-ought-six". Ahead of us as a nation, if we continue this irresponsible policy, is Micawber's dire predicament, "blossom blighted, leaf withered—forever floored".

There is no sane reason why the world's richest nation should continue to live the financial life of a profligate bankrupt. It is time now to set our house in order. The program called for is simple: (1) Eliminate waste and extravagance in government spending; (2) Balance the Federal budget; (3) Control the national debt and reduce taxes.

By such positive action we can protect future happiness—and prevent misery—for ourselves, our children and our children's children.

QUALITY · YOUNGSTOWN · SERVICE

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
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MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

Now you can choose

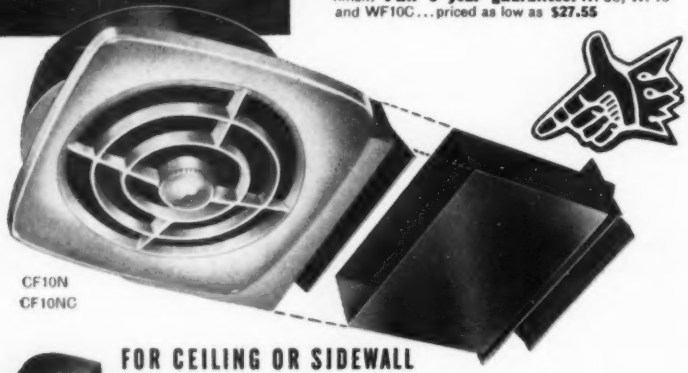
BERNS
AIR-KING
Ventilating Fans

for every purpose
— in any size
and price range

• wall switch controlled

low cost model AUTOMATIC SIDEWALL

Now available at the same price as pull chain models! Weatherproof outside hood protects against ice, snow, wind and rain—encloses scientifically counter-balanced, exclusive "Flutter-Free" shutter that automatically opens and closes when fan starts and stops. **Wall Switch controlled**—single or three speed (extra). Unscrewing of center grill knob removes grill for easy cleaning. Motor and blade completely removable by merely loosening two wing nuts. In 8-inch and 10-inch models for walls 4¼" to 28" thick. Sparkling white or chrome finish. **Full 5 year guarantee.** WF8C, WF10 and WF10C ... priced as low as **$27.55**



CF10N
CF10NC

FOR CEILING OR SIDEWALL

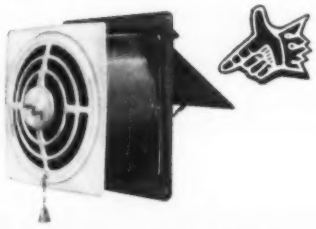
CF8C,

• **Only 3½" deep over-all**
• **Blower-type blade**

Most attractive, powerful, versatile kitchen fan available. New blower-type pressure blade maintains high air exhaust volume in long ducts. Mounts in ceiling or sidewall. Grill removes by merely unscrewing center grill knob. Outside frame will never warp or rust. Model CF8C especially recommended where low cost is a deciding factor. In White Enamel or Chrome finish. Available with 3-Speed Control switch (extra). **Full 5 year guarantee.** CF8C, CF10N and CF10NC ... priced as low as **$27.95** complete with Wall Cap.

ECONOMICAL PULL CHAIN MODELS

Where wall switch is not desired, this powerful, economical pull chain model is highly efficient. Eliminates wall switch installation cost. Outer frame will never rust or warp fan housing. Grill easily removed by merely unscrewing center knob. Motor mounted on one bracket —motor and blade completely removable by loosening just two wing nuts. Available in 8" and 10" models, white enamel or chome finish for walls 5½" to 16" thick. **Full 5 year guarantee.** KF8N and KF10N ... priced as low as **$27.55**



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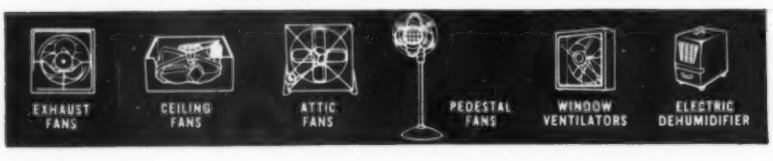

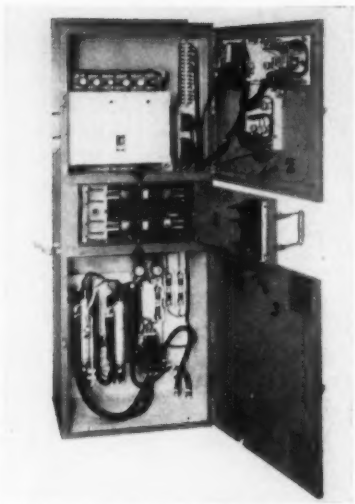

DUAL-PIN INTERLOCK prevents opening of welder control cabinet doors when disconnect switch is closed. Pins (arrows) engage holes in flange brackets on doors (2 and 3) when switch (1) is closed.

higher quality at reduced unit cost.

One example of this philosophy is indicated in the use of interlocking switch and doors on a welder control panel. While the JIC standards do not specifically require interlocked doors on disconnects for welding transformers, Ford uses a very practical safety device on this type of equipment.

As shown in the photograph, two small pins (arrows) in the housing of the disconnect switch in the center section of the panel enclosure completely interlock the top and bottom panel doors when the disconnect is closed. A flanged bracket on top door "2" (arrow) has a hole which centers over the line of the upper interlock pin when this door is closed. In a similar manner, the flanged bracket on lower door "3" centers over the line of the lower interlock pin when this door is closed. When the disconnect switch hinged cover "1" is closed, solid flange brackets push the top pin upward and the lower pin downward to engage the holes in the top and lower doors.

When the disconnect switch is in "open" position, the interlock pins return to normal position and the upper and lower doors can be opened.

Primary reason for this precaution is that the jackets of the water-cooled "ignitron" tubes in the lower section are at line (440-volt) potential and should not be accessible unless the disconnect switch is open. Maintenance and replacement ease are features of the control equipment.

Details of this construction were outlined by R. W. Kowitz of the Ford Motor Company Manufacturing Engineering Office in a talk on electrical safety and maintenance before an AIEE Machine Tool meeting.

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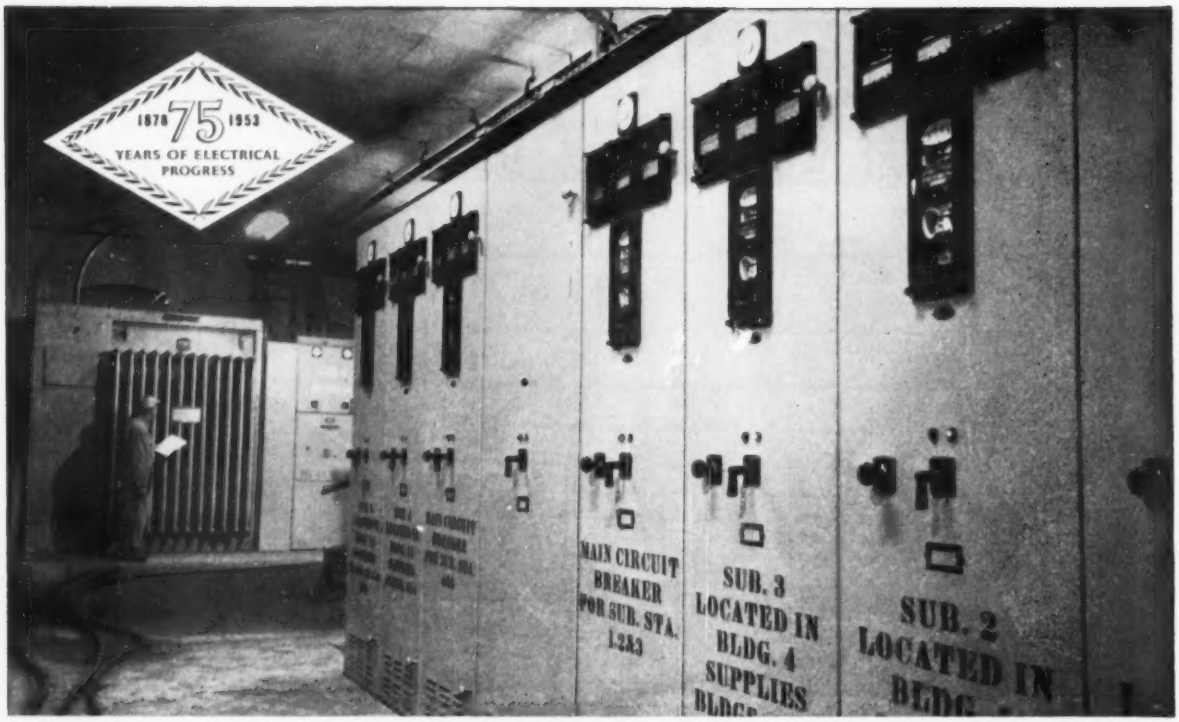
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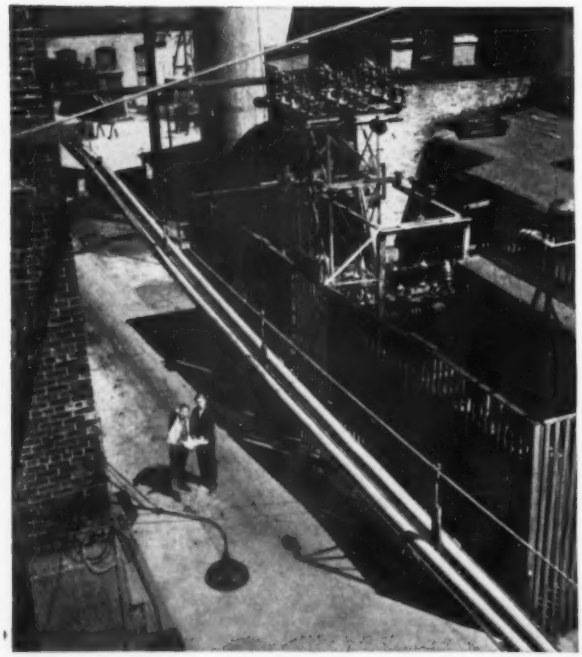
YEARS OF ELECTRICAL PROGRESS
MAIN CIRCUIT BREAKER FOR SUB. STA. 1-2-3
SUB. 3 LOCATED IN BLDG. 4 SUPPLIES
SUB. 2 LOCATED IN

KAISER-FRAZER selects G-E metal-clad switchgear to power modernized parts plant. Increased safety, protection against power shut-downs are provided by this 8-compartment, 4.16-kv lineup. Switchgear has two incoming line sections, tie breaker, five feeders—each feeding a 1000-kva load center, such as Substation No. 4 in background.

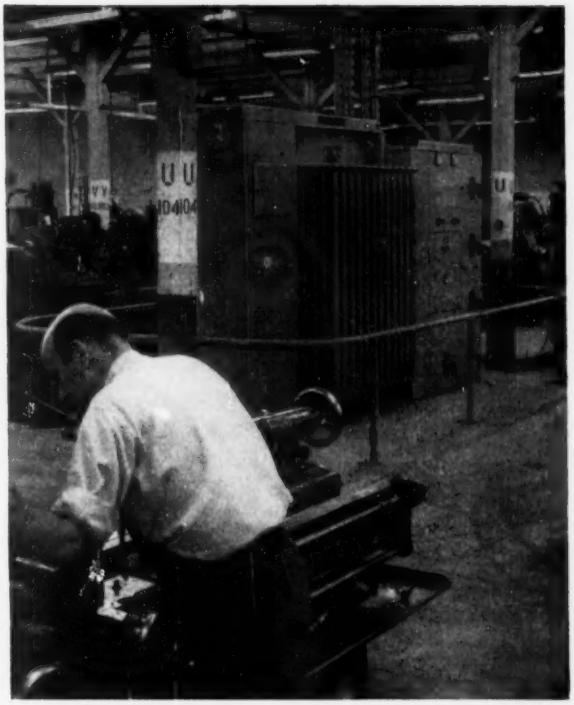
Kaiser-Frazer installs one of the most



EASILY installed armored cable, in center, replaces maze of old low-voltage cables at right—saves tons of copper.

TOOL ROOM shows interlocked armor cable leading to junction box, Trumbull Flex-A-Power* bus duct with plug-in connections.

FOR SWITCHGEAR CONNECTIONS, 700 feet of interlocked armor cable were pulled into position in 45 minutes. Cable can go under, over pipes, rafters, beams.



G-E UNIT SUBSTATION, one of five 1000-kva Pyranol* 4160-480Y/277 load centers in Kaiser-Frazer plant, powers nearby machines. Rail protects substation from battering of trucks.

modern plant power systems in America

New G-E metal-clad switchgear and radial load-center distribution system replace obsolete low-voltage system

In modernizing a factory in Dowagiac, Mich., for use as a parts plant, Kaiser-Frazer Company turned to General Electric for a complete electrical job.

A very important phase was the G-E engineered distribution system, installed by Koontz-Wagner Electric Company, Inc., of South Bend. This system features new, standardized metal-clad switchgear . . . replaces dangerous, inadequate equipment inside and outside the factory.

Two 3000-kva transformers, equipped with load ratio control, feed metal-clad switchgear through flexible interlocked armor cable. The compact, safe, metal-clad lineup, rated at 4.16-kv, in turn feeds five 1000-kva load centers in a reliable radial distribution system. High-voltage fluorescent lighting considerably reduces equipment costs. Neutral grounding increases system reliability and economy.

Kaiser-Frazer, with pre-assembled G-E equipment, has saved months of time, cut installation and maintenance costs, provided greater safety, and made the best possible use of plant space.

For information to help in your modernization plans, contact your local G-E sales representative—or write direct to General Electric Company, Schenectady 5, N. Y. 874-1

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TWO TRANSFORMERS, 3000-kva, 27-4.16-kv with load ratio control, are installed by contractor.

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"Off-The-Shelf" transformers meet exacting laboratory standards

Two conditions—the high level of safety required in their experimental work, and dependably constant voltages—influenced the choice of transformers when Union Oil Company constructed their outstanding new Research Center.

Westinghouse Dry-Type Transformers (now available in distributor stocks everywhere) filled both requirements.

The larger of the two transformers shown above is a 75-kva unit. It is located in the basement at the center of the load area, directly under the laboratory it serves. The 25-kva transformer in the background handles the lighting load.

Air cooled, containing no combustible materials, these transformers could be located safely inside the building. Because their small size and light weight made installation less of a problem, they were easily mounted at selected load points . . . thus eliminating long secondary runs that would cause line losses and undesirable voltage variations.

You can meet new or changing load problems effectively and economically with Westinghouse Dry-Type Transformers. Savings include lower maintenance, operating and power costs. For further information, contact your local Westinghouse representative or distributor. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70665

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In The News

MAINTENANCE SHOW SETS RECORDS

Comprehensive conference program, plant visitations, and exhibition of 7000 products related to machine and plant upkeep were features of 4-day Cleveland meeting attended by over 15,000 delegates.

DEMONSTRATING the tremendous interest that is becoming increasingly evident in all types of industrial maintenance, over 15,000 contractors, engineers, maintenance personnel and production executives converged on Cleveland January 19th to attend the 4th annual 4-day Plant Maintenance Conference and Show.

Jointly sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management, the Conference featured 67 events, including 3 general sessions, 16 sectional conferences, 42 round-table discussions, a banquet and five inspection tours through industrial plants.

Also setting a new record for comprehensive coverage, the concurrently-held Show displayed approximately 7000 products related to plant and machine upkeep. Participating companies exceeded 300.

Of prime interest to delegates representing the electrical field was a discussion on "Maintenance of Electrical Equipment" by Robert G. Edsall of Westinghouse. In analyzing the operations and responsibilities of the East Pittsburgh maintenance division, Mr. Edsall stated that, "Routine inspection is probably the most effective means of preventing electrical equipment from causing serious power outages and work stoppages. Simple routine checks at predetermined intervals are well worth the expense involved and savings, resulting from not having to purchase new equipment, and keeping the equipment in operation, are definitely inviting."

Duties and responsibilities of the Maintenance Engineer were discussed by H. W. Shockley, maintenance consultant for E. I. duPont deNemours, who declared that he must coordinate all shop and field activities, determine departmental and unit costs, allocate maintenance personnel to various plant operations as needed, guide improved programs covering shop layout, tool and equipment requirements, supervise the inventory control of maintenance materials and formulate training programs for men in his department.

In a talk on "Preventive Maintenance," George J. Martin, National Biscuit Co., stressed the point that, "the day of verbal maintenance orders, and making repairs only when equipment breaks down, is gradually disappearing and plants in all types of industry are using *preventive* methods either separately or as a complete program," As to the set-up of a comprehensive preventive program, he discussed the functions and uses of equipment and inspection records, work orders and time cards, stock withdrawal orders, monthly inspection reports and mechanical downtime reports.

"Maintenance Essentials" were thoroughly treated at two of the general sessions by a qualified panel of engineers, consultants and supervisors.

ENGINEER R. G. Walsh, Goldberg & O'Brien Electric Co., Chicago, studies electrical drawings on plan table in 28-ft. trailer which serves as combination field office, material storage room and workshop on an industrial project. To date, company has three fully equipped units.

Separate discussion under this heading included Cost Control, by H. E. Bliss, Lukens Steel Co.; Maintenance Equipment, by C. B. Muir, Canadian General Electric Co.; Compulsory Training, by C. O. Oren, Dow-Chemical; The Cost of Maintenance, by W. H. Pagenkopf, Western Electric; Performance Measurement as a Maintenance Management Tool, by Comdr. R. S. Stewart, CEC, USN, Bureau of Yards and Docks; Work Measurement and Standards, by J. B. Whitlock, Armco Steel Corp.; and General Maintenance Questions, by Stuart Whitehead, Calco Chemical Div., American Cyanamid.

Bliss declared that, "the effective control of repair and maintenance costs is today one of management's most important problems, with expenditures for these items ranging from 8- to 15-percent of each sales dollar. Sound planning, both short and long range, and firm administration of a comprehensive repair and maintenance program is essential if maximum savings are to be realized."

"Equal emphasis must be placed upon work planning, scheduling, tools and equipment," said Muir, who also placed stress on the fact that, "except in a very few cases, maintenance labor is fairly high class and, since much of this type of work is performed in overtime at premium rates, the maintenance department should be aided with the most modern tools and equipped with the latest types of equipment."

During parallel forums held the second day of the Conference, Maintenance Problems Related to Small Plants were discussed by W. A. Adams of the J. M. Lehmann Co. and by A. D. Buschmann of Perfection Stove; Maintenance in Medium Size Plants was analyzed by O. W. Graveley of Union Carbide and Carbon Corp. and E. J. Reitz of the Carborundum Co., while Large Plant Problems was the

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HAPPY RECIPIENT OF AW Certificate is Clif Simpson (right), managing director, Electric Association of Chicago, who had wiring in his home brought up to AW standards. A. J. McGivern, chairman of the Association AW Standards Committee makes the presentation at the recent Electrical Modernization Conference in Chicago.

subject of M. W. Reid, General Electric Co.

In this group of meetings, Adams mentioned that valuable maintenance information could be obtained from "manufacturers from whom we purchase our equipment, technical books now on the market, articles in leading periodicals, technical files, personal interchange of ideas at national conferences, plant engineering clubs and plant visits." "However," he continued, "we must learn to interpret what we read to make it best fit our requirements, and we must judge what we hear to determine its suitability to our needs."

Buschmann stated that, "well-trained maintenance mechanics properly supervised cannot function efficiently without proper housing, tools and equipment. An area large enough for all of the maintenance machinery, tools, stock crib, office, benches and miscellaneous equipment is the answer to the best housing for the smaller maintenance departments, and good equipment, not cast-off production machinery, is essential for servicing, repairing and installing today's complicated production tools." He also added that, "our mechanics must have power drills, saws, grinders, nut setters, drivers and hammers to name a few of the power tools needed to reduce time and manpower requirements of maintenance work. They must also have portable gas and electric welders, cutting outfits, power sweepers, lift trucks, tractors, scaffolding and dozens of other items."

Graveley stated that maintenance should be "sold" to departments involved, as opposed to imposing it by authority; a long range plan should be preferred to just quick action for

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Presidential Apts. select Pemco. Philadelphia's newest development utilizes Pemco's luminaires for beauty and uniformity of design, hoods used interchangeably as needed.

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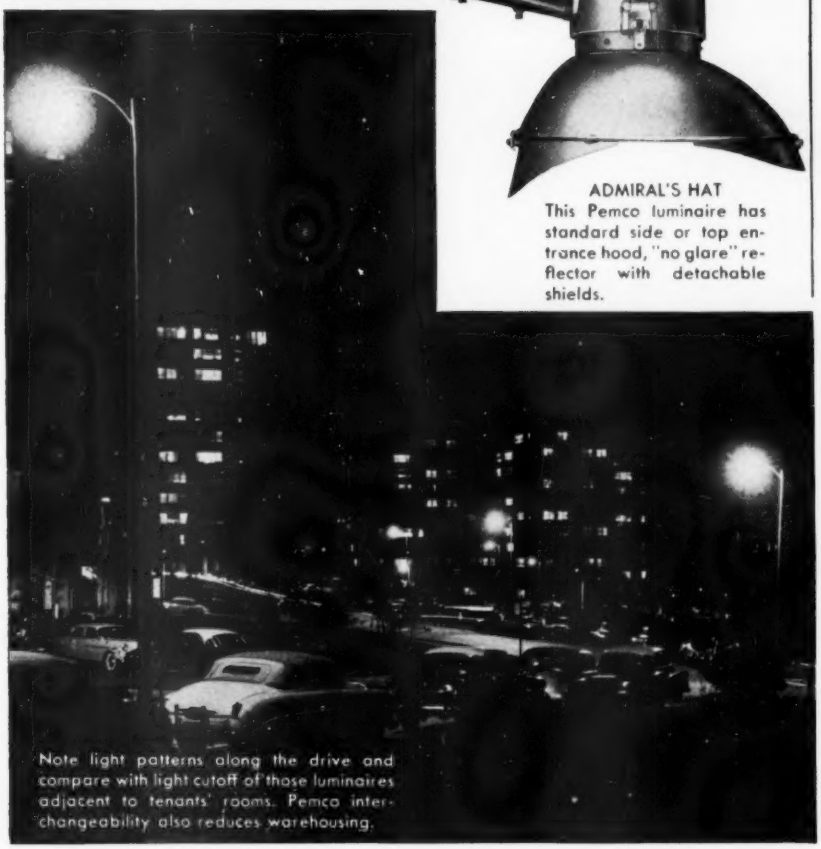

Note light patterns along the drive and compare with light cutoff of those luminaires adjacent to tenants' rooms. Pemco interchangeability also reduces warehousing.

Whether your project is shopping center, parking area, residential development or institution—you can rely on *Pemco* lighting products for *any* outdoor requirements. They're designed and engineered with the experience of 70 years. Write for our complete Lighting Catalog—no obligation!

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G-E chemical research has developed a new, economical, clear-baking insulating varnish that offers you many big advantages:

ALL-PURPOSE APPLICATION. With G-E 9700 you can cut down inventory by using a single varnish for several needs.

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TOUGH, DURABLE. It has high bonding strength and gives you a smooth, wrinkle-free surface that provides outstanding durability.

THROUGH CURING. G-E 9700 cures thoroughly in deep sections, and can be cured by heat from 110 C up to 150 C, depending on curing speed desired.

HIGHLY COMPATIBLE. G-E 9700 mixes quickly and easily with most other baking varnishes.

This new insulating varnish is ideal for treating all sizes of stators and rotors with speeds up to 10,000 r.p.m., transformers, coils, windings, and insulation such as paper, fibre, and laminates.

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You can put your confidence in—

GENERAL ELECTRIC

COMBINE FLEXIBILITY of direct current motors with simplicity of alternating current distribution to get maximum production from use of high speed automat'c machinery, R. A. Gueder, Reliance Electric and Engineering Co., Cleveland, tells contractors and plant men at recent Electrical Modernization Conference in Chicago.

immediate results; and the responsibility for equipment condition should be placed on the "user" rather than given completely to the maintenance department.

Reitz stated that, "Doing the ordinary plant maintenance repair and overhaul is not good enough today. To operate a successful maintenance program it must be controlled. You should know your present work load, the work load ahead and your allowed costs to do this work. To do this it is necessary to schedule, inspect and repair, budget and control, and train your men."

In comparing problems of large plants with those of smaller plants Reid mentioned that, since the areas covered are much greater and equipment more complex, larger organizations are necessary; and supervision has to be familiar with a more varied line of services. "The objective of our organization is to control these activities so as to give prompt service to the manufacturing sections, avoiding production shutdowns, and performing the necessary work in an efficient and effective manner," he summarized.

Problems in Plant Engineering were enumerated by E. A. LeGros of Lever Brothers, J. E. Galagan, General Analine and Film Corp., and J. R. Sautter, E. I. duPont de Nemours.

LeGros emphasized that the plant maintenance staff must keep abreast of technical advances through the mediums of books, magazines, manufacturers' representatives and trade associations, yet he mentioned that "outside electrical contractors should be cultivated to bridge the gap where

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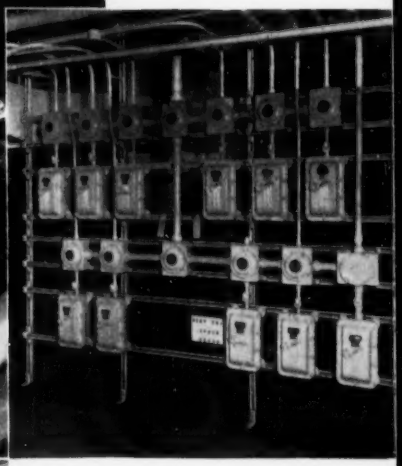
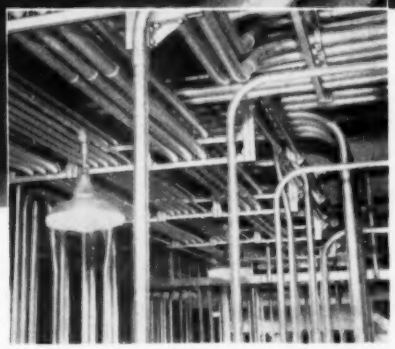
UNISTRUT framing and pipe clamps support heavy banks of conduit leading to motors in plant of large pharmaceutical manufacturer.





Load center built with UNISTRUT channel and fittings. Framing system's adjustable feature permits quick location of gear to spot desired.

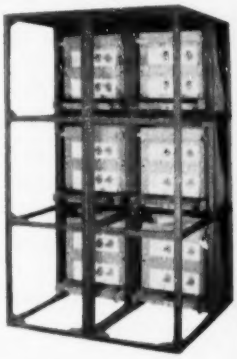
Photo shows how a large power company used UNISTRUT framing and pipe clamps to rack rows of conduit in steam plant installation.

Framework of UNISTRUT channel and fittings support switch gear in typical cubicle installation.

Rack conduit, cable and pipe—
Frame power load centers—
Mount switches, meters and panelboards

Those who use completely adjustable UNISTRUT metal framing know it's easy to handle and quick to erect—that it provides great strength without bulk—that adjustments, changes and additions are easily made at any time.

The UNISTRUT system cuts costs, too. You save time in engineering detailing and eliminate the need for trained erection crews—anyone can build with UNISTRUT channel and fittings. No drilling, no welding, no special tools or equipment—all you need is a hacksaw and a wrench to build wire and cable reel racks, fluorescent fixture supports, transformer vaults, electric motor mounts, bus duct supports and many other structures. It will pay you to try UNISTRUT framing on your next job.



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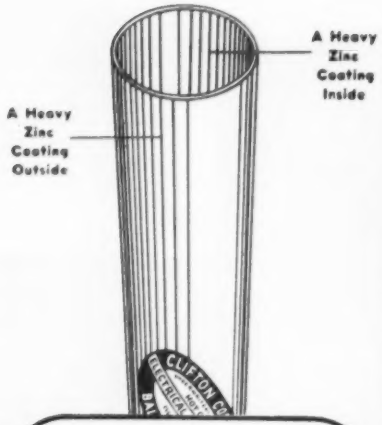

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CLIFTON E.M.T. is hot-dipped galvanized by a special process which deposits a uniformly heavy coating of zinc inside as well as outside the tubing, and bonds the coating to the steel tubing. Will not flake or chip.

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THE HAWES BROTHERS, John and Jim, of Huntington, W. Va., manage a comprehensive electrical organization, with memberships in NISA and NECA, and special divisions for engineering and appliance sales.

plant maintenance men are either too busy or are not versed in a particular problem."

Galagan brought out the point that, in many manufacturing plants, "there is a definite relationship between the man-hours of maintenance required to keep the plant in good operating condition, and the kilowatt-hours of electrical energy used by the plant or department. "This relationship," he said, "provides a useful tool in determining not only maintenance time schedules, but material and energy costs as well."

Sautter appealed for close cooperation between the maintenance, engineering and operation divisions, claiming that, "unless there is complete accord between these groups, manufacturing costs will increase. Preventive maintenance requires periodic inspections of equipment. Operation must give us this equipment for a definite interval of time. Therefore, if accord is *not* reached for these necessary shutdowns and equipment wears out or breaks down as a result, economic penalties will follow."

Among the many topics included for round-table discussion were those of Area vs Centralized maintenance with H. A. Fohl of Lukens Steel Corp. leading the discussion; Lighting, with Willard C. Brown of General Electric presiding; Selling Management on the Maintenance Program, led by R. S. Williams of De Laval Steam Turbine; Maintenance Stores, with C. J. Zetler of Westinghouse leading the discussion, and Maintenance in Electrical Manufacturing Plants, led by C. B. Muir of Canadian G. E.

To provide maximum opportunity for delegates to meet in these off-the-cuff and off-the-record forums, each program was presented twice, thereby making it possible for the participants to either intensively concentrate on one subject, or be able to include more topics on his schedule than would have been possible under other arrangements.

From the opening remarks by general chairman L. C. Morrow (consulting editor of *Factory Management and Maintenance*) to the final banquet address by Tell Berna (general manager of the National Machine Tool Builders Association), the importance of maintenance in the nation's production picture was effectively presented for, as Mr. Morrow concisely phrased it, "Maintenance *has* to be considered along with production in terms of unit cost, rather than treated as general overhead. As machines become more automatic the *production* worker will have less need for highly developed skill. But the *maintenance* man will have to acquire skills to match the complications of the machine. This is a coming responsibility and forward-looking companies already are taking steps to train and develop maintenance employees to take over this important key assignment."

New Orleans Electrical Assn. Elects Officers

J. R. Guidroz was elected and installed president of the Electrical Association of New Orleans, Inc., at the December meeting. He succeeds Walter J. Barnes, who was named ex-officio member of the executive committee.

Other officers elected and installed included George D. Sims, executive vice-president; A. B. Paterson, Jr., vice-president, representing wholesalers, utilities and manufacturers; C. B. Raborn, vice-president, electrical

ELECTRICAL INSPECTORS H. C. Auld (left), Moline and Peter Warner, Danville, discuss Danville's ordinance requiring permits and inspection of television receiver antennae.

COPE Cable Trough is Used by Utilities and Industrial Plants Throughout the World

The ease and economy of installing standard COPE Cable Trough has given it wide acceptance among the leading utilities and industrial plants around the globe. They realize, as will you, how COPE Cable Trough saves on time, material and costs.

Write for full information.

COPE Cable Trough Installation at Gary Sheet & Tin Mill—U. S. Steel Company

A few of the Users of COPE CABLE TROUGH . . .

Allis-Chalmers Manufacturing Co.
Aluminum Company of America
Atlantic City Electric Co.
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Carolina Power & Light Co.
Central Hudson Gas & Electric Corp.
Cincinnati Gas & Electric Co.
Cleveland Electric Illuminating Co.
Commonwealth Edison Co.
Connecticut Light & Power Co.
Consolidated Gas, Electric Light & Power Co. of Baltimore
Delaware Power & Light Co.
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Detroit Steel Corp.
Dow Chemical Co.
E. I. du Pont de Nemours & Co., Inc.
Ethyl Corporation
Ford Motor Company
Goodyear Tire & Rubber Co.
Indianapolis Power & Light Co.
International Harvester Co.
Island of Iceland
Jersey Central Power & Light Co.
Jones & Laughlin Steel Corp.
Kaiser Aluminum & Chemical Corp.
Kansas City Power & Light Co.
Kingdom of Egypt
Kingdom of Greece
The Mead Corporation
Monsanto Chemical Co.
Monongahela Power Co. and The Potomac Edison Co.
National Advisory Committee for Aeronautics
National Aniline Div., Allied Chemical & Dye Corp.
New England Electric System
New York State Electric & Gas Corp.
Niagara-Mohawk Power Corp.
Pacific Gas & Electric Co.
Packard Motor Car Co.
Pennsylvania Electric Co.
Philadelphia Electric Co.
Pittsburgh Plate Glass Co.
Republic Steel Corp.
Reynolds Metals Co., Inc.
Southern California Edison Co.
Union Electric Co.
United States Army—Corps of Engineers
United States Bureau of Reclamation
United States Navy
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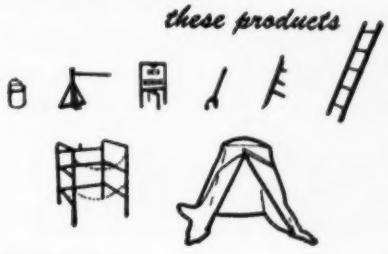
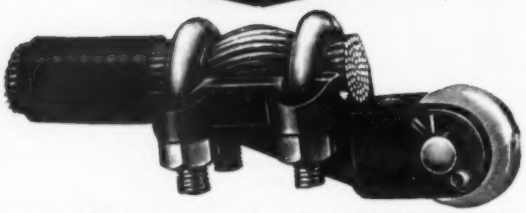


LOCK CABLE SAFELY, SECURELY *with*—

"EFFICIENCY" Cable Strain Clamps

without Strain or Damage



. . . withstands direct pull of 17,000 pounds

Efficiency Cable Strain Clamps lock cable safely and securely without possible strain or damage. "H" construction of clamps and high ridge across center of cable prevents cable from slipping. Takes cable from 1/0 to 1,500,000 c.m. Three clamp sizes cover all cable sizes. Furnished with eye or clevis, for AC or DC service.

Write for Catalog 38-A

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MANUFACTURERS OF EFFICIENCY ELECTRICAL DEVICES FOR CONDUIT, WIRE AND CABLE SUSPENSION

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"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

Save Time-Cut Costs

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OSTER

"Tom Thumb"

PORTABLE PIPE THREADER

● Note some of the jobs this No. 582 "TOM THUMB" machine can do for you: Ream, thread and cut-off in one 50-minute hour: 78 pieces of ½" pipe; or 64 pieces of 1" pipe; or 50 pieces of 2" pipe. Also, without using a nipple chuck, you can thread both ends of nipples as short as 3½" in the 2" size.

The Oster No. 582 "TOM THUMB" is the most advanced portable pipe threading machine you can buy. *It's a real time and cost saver for your business!*

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THE OSTER MFG. CO. 2081 East 61st St., Cleveland 3, Ohio, U. S. A.

☐ Rush copy of catalog bulletin on No. 582 "TOM THUMB."

☐ Rush names of Oster Distributor in our area.

NAME

COMPANY

ADDRESS

PARTNERS Andrew McKee (left) and Alex Morrison divide the administrative responsibilities at the McKee-Morrison Electric Co., Windsor, Ontario, Canada. McKee handles motor repairs, while Morrison supervises the construction department.

contractors; C. J. Hanemann, vice-president, air-conditioning and ventilation; R. J. Magoni, vice-president, radio and television; W. E. Clement, director of publicity; E. H. Mowen, secretary; I. W. Tufts, treasurer, and W. P. Massey, R. E. Brugier, E. N. Avegno, A. A. Demarest, C. C. Langwith, Al Levin, J. B. Dunn, J. N. Roos, Charles Pearson, Jr., and Mr. Barnes, members of the executive committee.

NISA News

New York is getting ready for the forthcoming 20th Anniversary Convention which will be held in New York's Hotel Statler, May 24-28.

Recently, chairmen of all convention committees met at the Hotel Shelburne, Headquarters of New York Metropolitan Chapter. The following were present: M. Friedkin, L. Kennedy, H. Griffith, H. Lidsky, A. Shovan, A. Bonahur, S. Bojak, H. Englemann, J. Brown, W. Wheeler, W. Prise, H. Forrestier.

The program will include a number of outstanding speakers, field trips, visitation of members' shops and a few trips to many attractions of New York City. Detailed announcement of program and schedule of events will go to members very soon.

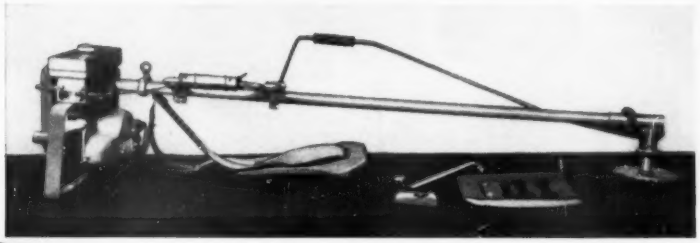
• • • •

Excel Electric Service Co., Chicago, celebrated its 25th anniversary, Nov. 22, with a dinner party for employees at the Conrad Hilton Hotel. Seven men were honored during the event for 25 years of service. Among those honored were J. F. Ferrari,

SPEED! SAFETY! EFFICIENCY! ECONOMY!

BRUSHMASTER

REVOLUTIONARY NEW BRUSHCUTTING MACHINE



- ONLY 35 LBS! EASILY OPERATED!
- OPERATION COMPLETELY PROTECTED!
- DOES WORK OF 6 HAND-CUTTERS!
- DOES NEATER, TRIMMER JOB!

Companies required to maintain right-of-way clearance are slashing costs with the new Brushmaster! Operated by ONE MAN, it does a faster, better job than a crew of good hand cutters . . . proven by time study! The one truly efficient, low cost way to clear brambles, vines, brush, bushes . . . even saplings up to 4" in diameter!

RUGGED! DEPENDABLE!

Only 35 lbs. overall weight . . . yet Brushmaster is designed for peak efficiency! Air cooled, 2 cycle motor is really dependable . . . field tested under all conditions. Shaft-driven circular saw blade can be replaced in seconds. Write for complete specifications.

Opportunity . . . BRUSHMASTER FACTORY DEALERSHIP

NOW . . . ACT QUICKLY

CHOICE TERRITORIES AVAILABLE!

$ **WRITE TODAY** on your own letterhead for complete details of procuring a valuable Brushmaster Factory Dealership!

$ **SURE-FIRE SALES PROMOTION PLAN . . . FREE.** Yes, every Brushmaster Factory Dealer receives a completely prepared package promotion plan which practically guarantees sales of this sensational new brush cutting machine!

H&R

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Subsidiary of HARRINGTON & RICHARDSON ARMS CO.

ESTABLISHED 1871

Write to 290E West St., Keene, N. H.

Manufacturers and Selling Agents in Canada: H & R Arms Co., Ltd., Drummondville, Quebec

EVERYONE
HAS A USE FOR

MULTI SPARLITE

FOR USE WITH PAR 38 LAMPS

Furnished with six feet of rubber covered wire & attachment plug. Socket is protected from weather by permanently fixed gasket. Housing is one piece drawn steel, thoroughly plated. Packaged one to a carton, can be furnished with spike for turf mounting.

CAT. NO. 800
Available with lens holders for colored lens.

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the Emblem of Quality
in signals and systems

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You want the best there is—from a simple push button to a complex signal system. For more than 77 years Faraday has supplied home and industry with the finest electrical equipment. Consult your electrical wholesaler for details on the complete Faraday line.

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SPERTI FARADAY INC. ADRIAN, MICH.
BELLS · BUZZERS · HORNS · CHIMES · VISUAL AND AUDIBLE PAGING DEVICES AND SYSTEMS

DAD CHECKS THE PRINTS while Son checks Dad in the office of the Erb (Peter J. and P. James) Electric Company, Wheeling, W. Va.

president; B. V. Ferrari and E. J. Clohesey, vice-presidents; and Paul Hoffman, founder of the company, all of whom have been associated with Excel since it first began operation in 1927.

• • • •

Henry A. Peterson, Mason City, Iowa, has bought the interest of his partner, Keith Poshusta, and has changed the name of the company from K&H Electric to Electric Motor Service.

• • • •

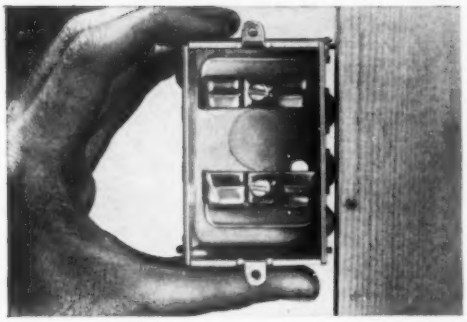
Edwin L. Stecker, founder, Stecker Electric Co., Detroit, died Nov. 30. He was 67. He started his company in 1919, and in 1948 founded the Stecker Hardware Co., Dearborn, Mich. He is survived by his wife, Florence, and sons, Kenneth and Allan.

• • • •

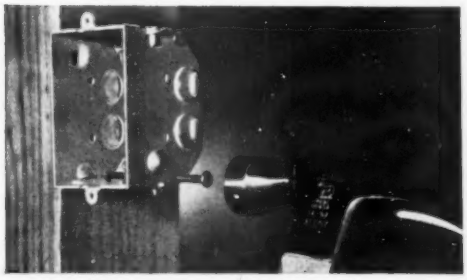
The Greater Cleveland Chapter has elected officers for the coming year and has changed its chapter name and redefined its area. The reactivated group has taken the official name of "Greater Cleveland Chapter" and has included in its area the Ohio counties of Cuyahoga, Lorain, Medina, Lake, Geauga, and Summit. New officers are: J. Lee Ruppersberg, The Reserve Electric Co., Cleveland, president; Francis G. Allan, Elliott Electric Co., Cleveland, vice-president; George K. McKeowan, MQN Electric Co., Willoughby, Ohio, secretary; and George Baumgardner, Independent Electric Motor Repair, Cleveland, treasurer.

The Cleveland group is busy with plans for the Plant Maintenance Show, scheduled Jan. 19-22 at their city's Public Auditorium. This important industry event has brought the group together with a common purpose and has resulted in the addition of six new

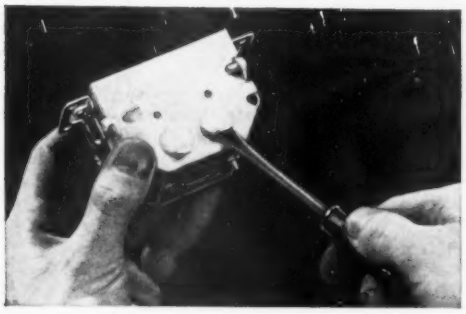
How G-E Levelock boxes cut roughing-in time 5 ways



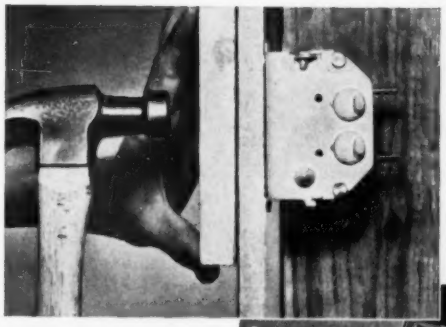
1. Four leveling projections — instead of the usual three, keep G-E Levelock boxes straight and level when mounted against studding. Wall plates go on with even, uniform neatness.



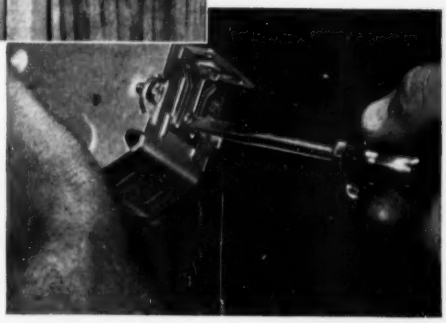
2. Special nail through holes—for real mounting speed without taking the box apart. The nail through holes are in addition to the conventional side-plate nail holes.



3. Side pryouts—solve unusual installation problems. Easily and quickly removed by a simple twist of a screwdriver blade.



4. Exclusive locking design — keeps side plates tightly wedged in position. G-E Levelock boxes won't fall apart when carpenters scribe cutouts — no time wasted in fishing for boxes lost in partitions.



5. Single-screw ears and ⅛-inch guide marks — permit quick adjustment to any wall thickness. Ribbed design and the bridge across the ear give increased strength.

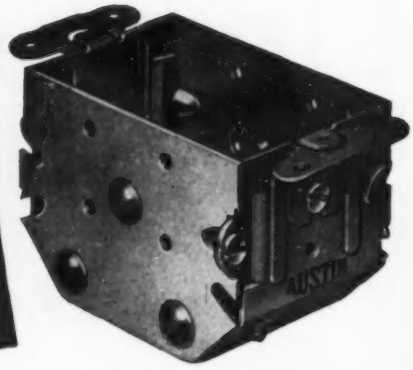
G-E Construction Materials Distributors offer 21 G-E Levelock Sectional Device Boxes.

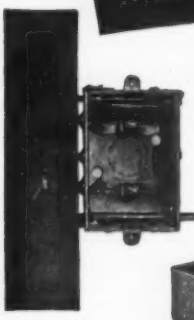
Use the time-saving features of General Electric Levelock device boxes on your next wiring job. You'll find 21 Levelock boxes to choose from at your G-E Construction Materials distributor. All Levelock boxes are designed to speed wiring. Section C20-218, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

GENERAL ELECTRIC

AUSTIN'S *Improved* LR BOX

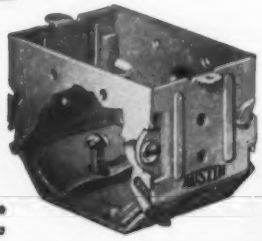




Nails to Studding Evenly, Accurately, in a Matter of Seconds . . .

Faster Installation!
Nail holes in box sides provide fast, easy installation. Saves money by eliminating bracket. Nail heads driven in tight—box is never out of line.

Perfect Alignment!
3 nubs facing outward on each side of box prevent box from tilting. First nub is 7/8" from front of box to permit adjustment for wallboard or plaster.



For use in Old or New Wiring

Write for descriptive price sheet No. A-1-a

The M. B. Austin Company
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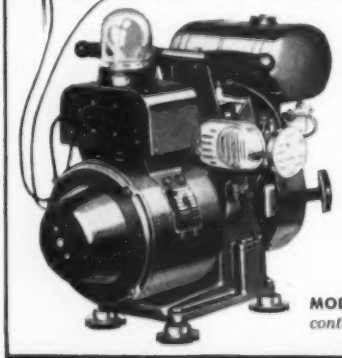
KOHLER ELECTRIC PLANTS
Independent Source of Electricity

Portable electricity saves time!

Low-cost portable model helps finish wiring jobs faster. Saves expense and bother of temporary power line hook-ups. Operates floodlights, electric drills, saws, other tools having universal (AC-DC) motors. Develops 1500 watts DC. Weighs only 101 lbs.; handle for carrying. Other sizes 500 watts to 30 kw, of various voltages in single and 3-phase models. Stand-by models for protecting home or public and commercial electrical equipment when central station power is cut off. Write for folder 23-L.



MODEL 1.5MS, *1500 watts, 115 volt DC. Manual control. Also 115 volt AC, weighing 130 pounds.*

Kohler Co., Kohler, Wisconsin. Established 1873

KOHLER OF KOHLER

PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS
AIR-COOLED ENGINES • PRECISION CONTROLS

DESIGN ENGINEERING for conversion of 25-cycle electrical equipment to 60-cycle operation is taking a lot of time from the shop superintendent duties of Eric Willoughby, Johnson-Turner Electric Repair and Engineering Co., Ltd., Windsor, Ontario. Canada is in the midst of a long-term frequency conversion program.

chapter members to the group of five firms who were originally included.

• • • •

New England Chapter held its regular meeting in Hotel Bradford, Jan. 8. The business meeting was called to order at 8:30 P.M. by the president, Harry Bedig. There were 50 members and two guests present. The secretary's report was read and accepted. Chairman of the program committee announced that an interesting February meeting is planned. Mr. Fred Ferris is to be chairman of a panel discussion for that meeting.

Future meetings will have a short period allocated to shop discussions.

The Question Box was conducted by Paul Leicht. One question—are any of our shops using electronic testing equipment?—resulted in a brief but interesting discussion.

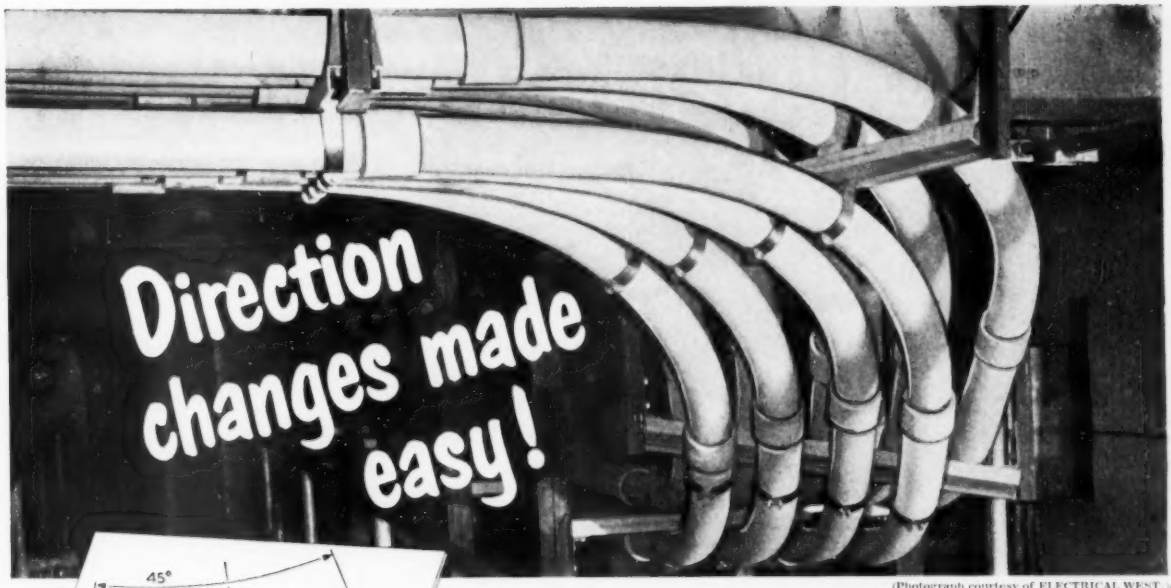
Attention was also called to the coming foreman's meeting on March 14, by Mr. Bedig.

Mr. Kolhonen introduced the speaker of the evening, A. E. Vaughn of Vaughn's Pricing Service, who gave a very interesting talk on what we should charge for our services. Following his talk Mr. Vaughn conducted a short question period.

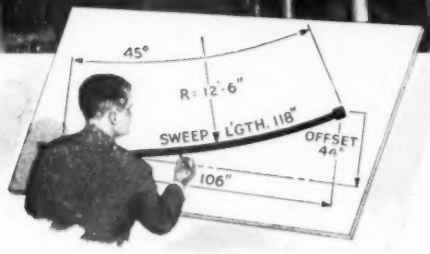
From Walter J. Prise, The Maintenance Co., New York City.

Breaker Making Methods Shown

Automatic machinery and methods developed for the manufacture of low cost circuit breakers was shown to a group of technical and business magazine editors last month by executives of the Federal Electric Products Co. as the 10,000,000th Stab-lok came off



(Photograph courtesy of ELECTRICAL WEST.)



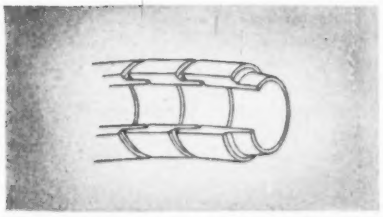
. . . with standard fittings for TRANSITE *asbestos-cement* DUCTS

When you use Transite Ducts, you have available a wide variety of standard fittings, made of the same asbestos-cement material as the ducts themselves. These fittings save time and expense because they provide maximum flexibility in laying out or constructing a duct system. They facilitate clearing unexpected obstructions or accommodating revisions in the original layout.

For instance, the new Transite 5° Bend Segments (shown at left) can be used alone to form simple and complex curvatures of any multiple of 5°. Used with other standard Transite curved fittings, they form curvatures of odd degrees. Thus, they enable you to simplify cross-overs and transformations . . . to clear obstructions . . . to form unusual or special bend or offset sections. They eliminate the need for purchasing special radii bends or sweeps.

The other standard Transite fittings that facilitate directional changes are the offset bends, standard 45° and 90° bends, sweeps, curved segments, laterals, tees, elbows and deflection couplings. These fittings are machined to a standard taper so that they can be used with Transite Conduit, Transite Korduct or with other Transite fittings.

For more information, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, address 199 Bay Street, Toronto 1, Ontario.



5° bend segment sketched in detail. It consists of a straight section of Transite stock with a male taper on one end and a female taper on the other . . . each machined at an angle of 2½° to the center axis. Segments can thus be used single, or combined to form bend sections whose curvature is any multiple of 5°.

Photograph showing use of bend segments and curved segments with Transite Ducts.

5 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. **Corrosion-Resistant.** Transite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.
2. **Permanently Smooth Bore.** Transite makes long cable pulls easy, under any conditions. Danger of damage to cables is also minimized.
3. **Incombustible.** Transite will not burn or contribute to formation of smoke, gases, fumes. It confines burnouts, will not soften under heat.
4. **Higher Thermal Conductivity.** Cables run cooler in Transite, reducing I^2R losses, increasing current capacity and prolonging insulation life.
5. **Easy to Install.** Transite Ducts are light weight, easy to handle. Joints are quickly made. Long 10-foot lengths reduce number of joints in line.

JOHNS MANVILLE PRODUCTS

Johns-Manville TRANSITE® DUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

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SIGNAL
Telephone Ringing
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Immediately Available **FOR CIVILIAN DEFENSE**

These Relay sets have already been installed in many leading communities for operation of Civilian Defense Alarms.

The SIGNAL Relay Set can be installed quickly and easily. It is designed to operate on standard telephone ringing current of 15 milliamperes at 90 volts, 20 cycles.

The Telephone Ringing Relay Set has been proved in service and is of the same high quality which characterizes all relays, devices, and control systems built by the Signal Engineering and Mfg. Co.

Sales Representatives in Principal Cities,
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Wheelock RELAYS
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AUSTIN "SCREW-ON" CONNECTORS

Licensed under United States Letters Patent No. 1,933,555

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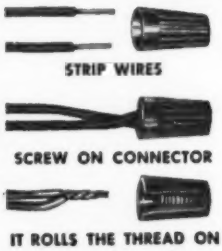
are faster, safer and neater—

NO SOLDER, NO TAPE, NO ADDITIONAL TOOLS

The Austin Screw-on Connector is a molded phenolic plastic shell with a copper coated spring inserted *after* molding. Provides 25% lower electrical resistance and up to 3 times the tensile strength.

Just strip the wires, insert into connector, and twist. The spring expands and rolls a thread onto copper conductors. When you stop twisting, the spring tightens down and grips conductors firmly. Connector is skirted so insulated portion of wires is drawn up into connector for complete insulation.

Write for Information and Prices



THE M. B. AUSTIN COMPANY
NORTHBROOK, ILLINOIS

the line. Federal, which first introduced circuit breaker panels at a price level comparable with equivalent fused equipment, reached this production record on Stab-lok in 2½ years.

Original product design was coordinated from the beginning with automatic machinery design. The "metal heart" of the unit, including contact, bi-metal, magnetic trip, line stab and braid, is completely assembled and calibrated by ingenious automatic machinery before it is inserted in the case. Automatic electronic equipment also tests each unit.

The efficient metal stamping techniques of the automotive industry has been adapted to produce boxes. 400 ton automatic presses with multiple dies press out complete enclosures at the rate of 1400 per hour.

A bus duct electrical distribution system and modern automatic controls including many electronic devices are an important feature of the low cost production design.

Electrical Equipment Featured at Home Show

Major electric appliances, heating and cooling systems rated high in interest at the home show held by NAHB in Chicago January 18-22. A record crowd of over 18,000 contractors and builders attended the 9th annual convention and exposition of the National Association of Home Builders to look over the latest in building products and equipment.

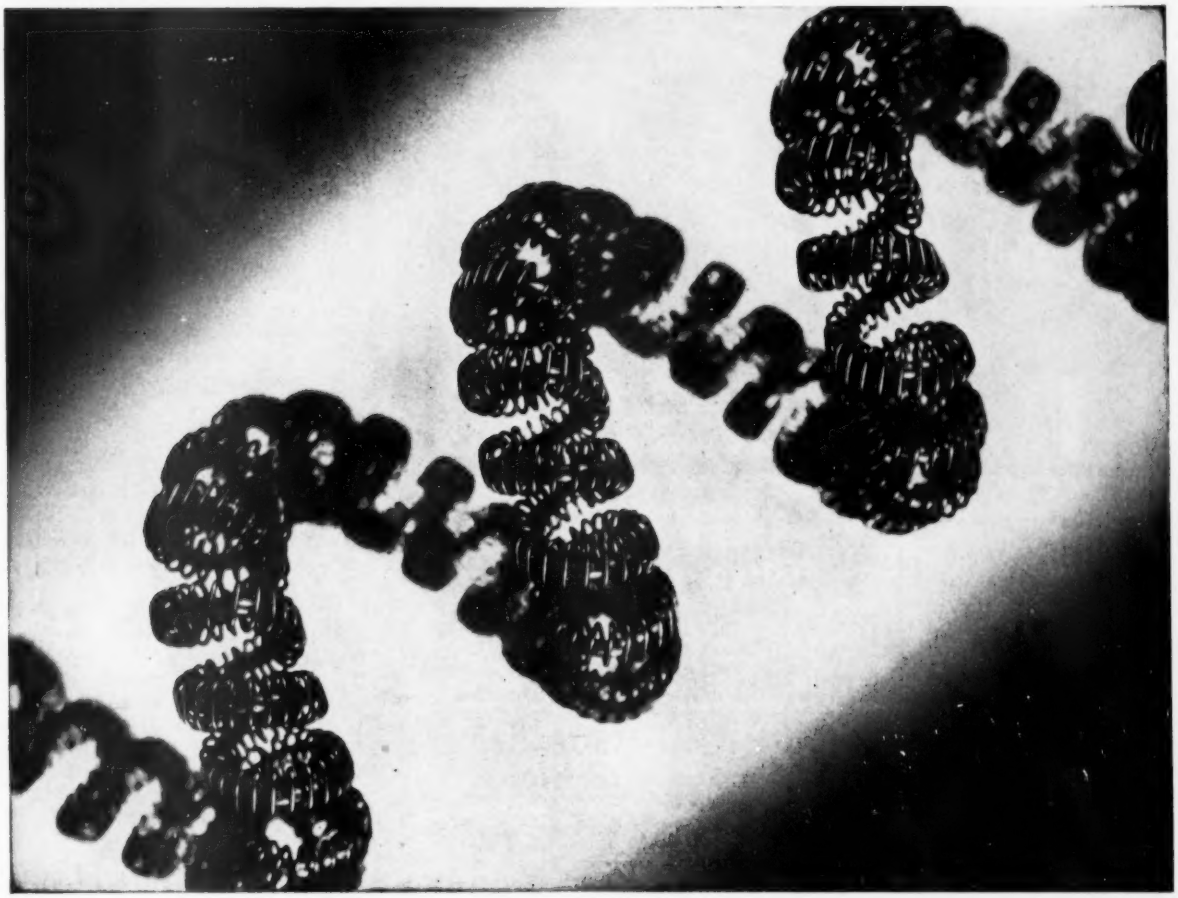
Central summer air conditioning was prominently featured with 2 and 3 ton sizes dominant. New designs are compact, some are twinned with oil or gas heating plants using common air moving equipment. Most use 2 or 3 hp single phase capacitor start motors, however one design shown employs 2 or more 1 hp units in multiple with sequence starting control. Many builders reported that central summer air conditioning will be featured in their 1953 projects.

Room coolers were displayed by many manufacturers with the larger capacity window units, ¾ and 1 ton, which require full circuits or special 220 volt circuits, gaining in interest. One manufacturer's display showed under-the-window installation in special framing.

Electric ceiling panel heating operating at 22 watts per square foot attracted lively interest. The panels are ⅛ in. thick and applied to the ceiling with adhesive. Wiring and connections are provided by small surface wiring channels where the edge of the panels abut the walls.

Electric dryers and a new combination washer-dryer were among the

New G-E fluorescent lamp starts fast, needs no starter



THE triple coil filament developed by General Electric, and shown greatly magnified above, now makes possible another great new fluorescent lamp! It's the G-E RAPID START fluorescent lamp. Combined with General Electric's new RAPID START ballast, it starts with quick 1-2 action. There's no starter needed, so maintenance is easier, costs less. Flicker is eliminated. Hum is reduced to a minimum.

G-E RAPID START fluorescent lamps will be available soon. This newest development of General Electric research is another reason why you can *expect* the best value from G-E fluorescent lamps.

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ELECTRICAL CONTRACTOR L. P. Harvey, half of the Schoolfield-Harvey team in Charleston, W. Va., was caught during one of his brief visits to his office between project inspections.

heavy duty appliances shown. Load requirements run around 5 kw on special 220 volt circuits. Interest was strong on built-in cooking units with separate range tops and ovens designed for custom building into cabinets and counter tops.

Kitchen ventilators and attic fans were among the leaders in air handling equipment and electric air cleaners were shown by two manufacturers.

Three exhibits were devoted to various features of wiring: a demonstration of plug-in strip, a display on telephone raceways and a line of television outlets.

A clinic conducted by the Edison Electric Institute reviewed the "plus features" offered by modern appliances in new homes. Guest speakers at the clinic were W. E. Slabaugh, Jr. of the Westinghouse Appliances Division, H. H. Green of General Electric Company, and W. R. Milby, Assistant Superintendent of Detroit Edison Customers Service Division.

Electric Institute of Boston Elects Officers

Arthur W. Coombs, New England sales manager of the Simplex Wire & Cable Co., Cambridge, Massachusetts, was elected president of the Electric Institute of Boston, Inc., at its 8th annual dinner meeting on January 22. John G. Waddell was re-elected managing director of the Institute, which now has 600 members representing all branches of the industry.

Directors elected from the contracting branch were Maurice Collins, Anderson-Coffey Co.; Louis J. Gianelli, Universal Electric Co.; William H. Hughes, W. H. Hughes Electric Service Co., and Bernard F. White, White Electric Co.

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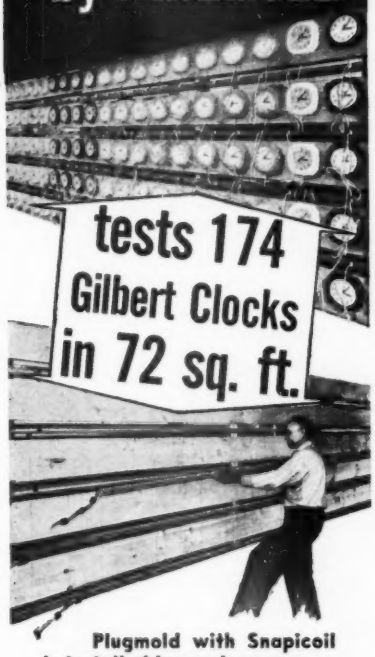

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National Adequate Wiring Conference—Ninth annual conference, LaSalle Hotel, Chicago, Ill., February 26 and 27.

Electrical Industry Convention—Nicollet Hotel, Minneapolis, Minn., March 8-11.

National Electrical Manufacturers Assn.—Edgewater Beach Hotel, Chicago, Ill., March 9-12.

Industrial Electrical Exposition—Sponsored by Essex Electrical League, Terrace Room, Newark, N. J., March 10-13.

Electrical Maintenance Conference—Sponsored by the Electrical Maintenance Engineers Association of Southern California, Rodger Young Auditorium, Los Angeles, Calif., March 18-20.

Edison Electric Institute — Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 30-April 2.

Industrial Trade Show—Sponsored by the Electric Association of Kansas City, Exhibition Hall, KMBC Building, Kansas City, Mo., April 28-30.

Chicago Electrical Industry Show—Sponsored by the Electric Association and the Electrical Maintenance Engineers of Chicago, Conrad Hilton Hotel, Chicago, May 11-14.

National Fire Protection Association—Annual meeting, Palmer House, Chicago, Ill., May 18-22.

National Industrial Service Association—Annual convention, Hotel Statler, New York City, May 24-28.

National Association of Electrical Distributors—45th annual convention, Conrad Hilton Hotel, Chicago, Ill., May 24-28.

Edison Electric Institute—21st annual convention, Atlantic City, N. J., June 1-4.

American Institute of Electrical Engineers—Summer general meeting, Atlantic City, N. J., June 29-July 3.

N. Y. State Electrical Contractors and Dealers, Inc.—Annual convention, Saranac Inn, Saranac Inn, N. Y., June 29-July 3.

Illuminating Engineering Society—Hotel Commodore, New York, N. Y., September 14-18.

International Association of Electrical Inspectors—25th Jubilee meeting, Edgewater Beach Hotel, Chicago, Ill., September 21-26.

National Electronics Conference—9th Annual conference, Hotel Sherman, Chicago, Ill., September 28-30.

Industrial Electric Exposition—Hotel William Penn, Pittsburgh, Pa., October 6-8.

Canadian Electrical Manufacturers Assn.—Annual meeting, General Brock Hotel, Niagara Falls, Ontario, Canada, September 23-25.

National Electrical Manufacturers Assn.—Haddon Hall Hotel, Atlantic City, N. J., November 9-12.

National Electrical Contractors Association—Annual convention, Miami Beach, Florida, November 17-20.

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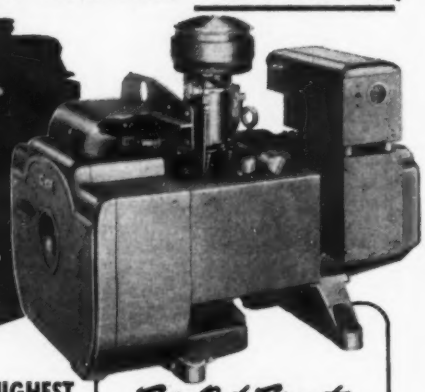

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Allis-Chalmers, Milwaukee, Wis.—Henry F. Banzhaf, manager of sales of control operation, Hawley Works.

General Electric Company, Syracuse, N. Y.—Eugene C. White, industrial specialist for the Tube Department.

American Steel & Wire, Cleveland, Ohio.—Van H. Leichliter, vice president of operations.

General Electric Company, Louisville, Ky.—Clarence H. Linder, general manager of the Major Appliance Div.

Westinghouse Electric Corp., Hyde Park, Mass.—William B. Cott, manager of air conditioning application engineering for the Sturtevant Div.

Columbia Electric Mfg. Co., Cleveland, Ohio.—Homer W. Sussman, general sales manager.

General Electric Company, Schenectady, N. Y.—Warde B. Stringham, commercial vice-president.

Luminous Ceilings, Inc., Chicago, Ill.—Fred Vorlander, eastern manager.

Pittsburgh Standard Conduit Co., Pittsburgh, Pa.—William C. Godfrey, assistant sales manager.

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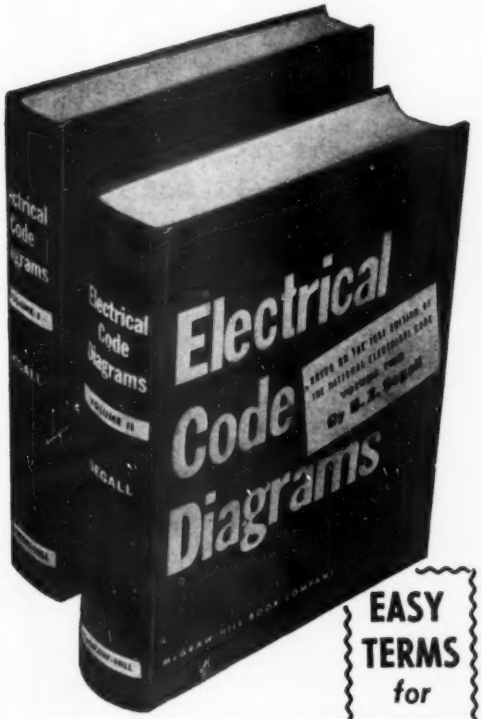

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INCREASED LUMEN OUTPUT and decreased size is the trend in mercury vapor lamps, Carl Jensen, Chicago, district engineer, lamp division, Westinghouse Electric Co., tells electrical groups as he outlines the development of modern light sources.

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[FROM PAGE 73]

two isolated cathode windings of 5 volts each. The lamp load has a power factor of approximately 50% lagging. Correction to over 90% can be made by placing capacitors across the line on the input side. Approximately 4 mfd per lamp will be required.

System Characteristics

In order to obtain the maximum range of light output, cathodes must be continuously heated. The instant-start lamps such as the slimline lamp group cannot be provided with cathode heat. Therefore, this electronic dimming system was designed for 40-watt preheat lamps only. Either Rapid Start or the starter type preheat 40-watt lamps can be used. Rapid Start lamps are preferred in installations where high humidity may produce marginal starting at the low end of the dimming range. However, circuit and ballast are designed so either lamp type can be used interchangeably.

Starting Requirements

In the discussion of Fig. 4 it was pointed out that a peak voltage is supplied to aid in starting the lamps. Since the effectiveness of the peak voltage in starting the fluorescent lamp depends on the capacity coupling from lamp to ground, there should be a grounded metal plate near the lamps; for most applications, luminaire metal housings or wiring channels will suffice. If open wiring on a wood panel is used, there should be a one-inch metal strip running the entire length of the lamp and placed approximately ⅜-inches behind the lamp. This strip should then be connected to the grounded line wire through a ½-megohm resistor.

Brightness Range

The system provides for relative brightness varying at least 100 to 1. Under optimum conditions of line voltage and ambient temperature, and with well seasoned lamps, the brightness range can be increased to 250 to 1. New lamps may not start immediately at the low brightness level, and it is recommended that new lamps be seasoned at normal brightness for a short time to provide the maximum dimming range for all lamps.

Color and Efficiency

Fluorescent lamps on dimming circuits offer several advantages over filament lamps: higher efficiency over

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the dimming range, lower operating costs, and better color control. Filament lamps become increasingly red as they are dimmed; fluorescent lamps change very little in color over their entire brightness range. A comparison of efficiencies of fluorescent and filament lamps is given in Table I. Figures shown are for color of approximately equal chromaticity, with lamps at their normal brightness.

The Chart in Fig. 11 shows a comparison of the approximate efficiencies of warm white fluorescent and 200-watt filament lamps for a wide range of dimming. No consideration is given to the change in color of the filament lamp as it is dimmed.

This Chart does not include the losses of the ballasts or control equipment for fluorescent lamps. The total loss will vary depending on the number of lamps in the load. However, with 35 lamps on the control unit, there will be a nearly constant loss of 3.5 watts per lamp over the dimming range. The individual ballasts will have approximately 10 watts loss at the highest brightness, and 4 watts loss at the lowest brightness.

Applications

There are many applications for brightness control of fluorescent lamps. The greatest demand for this added flexibility of fluorescent lighting has come from the theatre and stage lighting field. However, many others can now make use of the advantages of fluorescent lamps with controlled light output. TV studios, auditoriums, restaurants, night clubs, hotels, display areas, show windows and experimental laboratories are included in the list of lighting fields for which this system is expected to serve a useful purpose.

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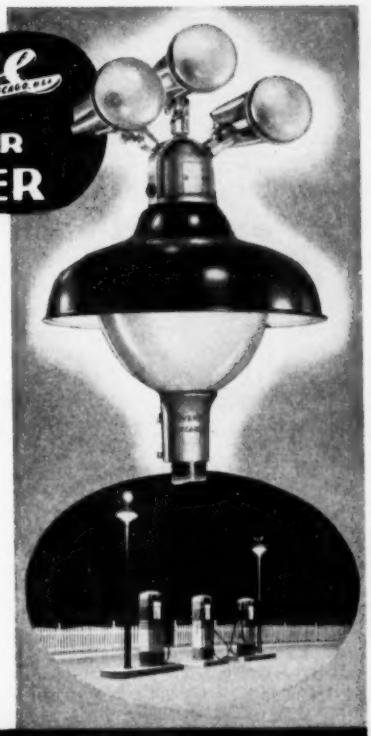

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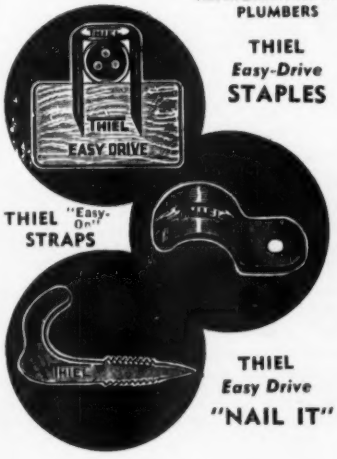

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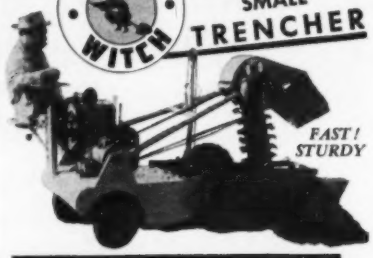

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[FROM PAGE 83]

working is that of adequate symbols for the large variety of electrical components shown on diagrams. Many may have attempted solutions either by adhering closely to the present ASA Standard, or, like the Ford Motor Company, by issuing a set of symbols found to be most practical for individual needs. A working group delegated by AIEE and composed of representatives of steel, rubber, photographic, machine tools, control manufacturers, elevator, and automotive industries have come up with a compromise solution. We hope this will be satisfactory and adopted by all concerned. The benefits are apparent of using symbols which are easily and quickly made on the drawing board, easily and quickly understood by those who must use them for installation and maintenance purposes, and yet limited in number so that they may be easily memorized.

The JIC Electrical Standard is a direct benefit to any progressive company—be its product automotive, home appliances, textiles, or what have you. Greater safety for the operator builds confidence in his ability and pride in his work, resulting in better employer-employee relations. Approximately 50% of all paragraphs in the standard have a direct relation to safety. Fewer breakdowns of shorter duration means increased production of higher quality at reduced cost of the end product. Such equipment builds a good reputation for itself and its manufacturer in the minds of all concerned. After all, what is any standard but the solution to a repetitive problem.

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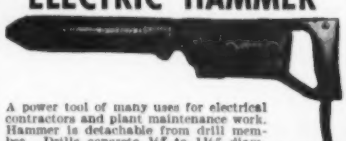

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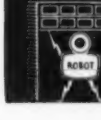

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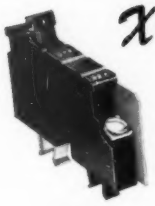

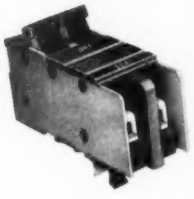

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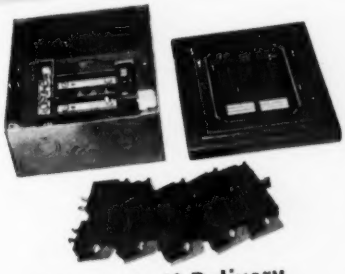

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